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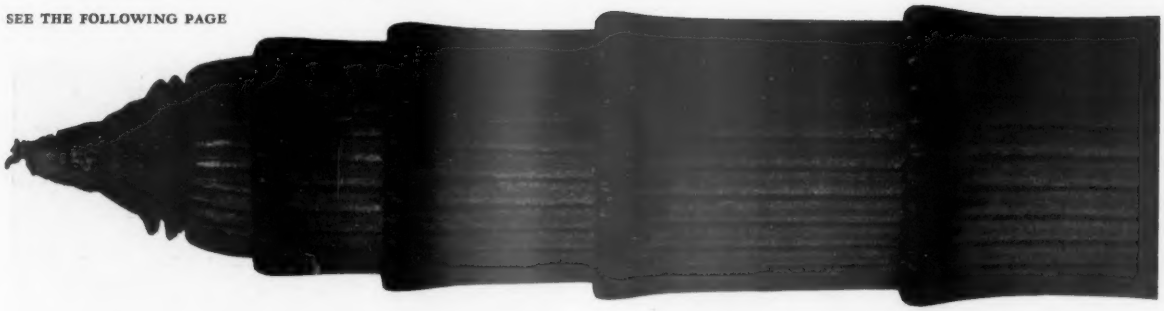

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EDITOR J. RHYNE KILLIAN, JR.

PUBLISHER HAROLD E. LOBDELL

CONTRIBUTING EDITOR JOHN J. ROWLANDS

BUSINESS MANAGER RALPH T. JOPE

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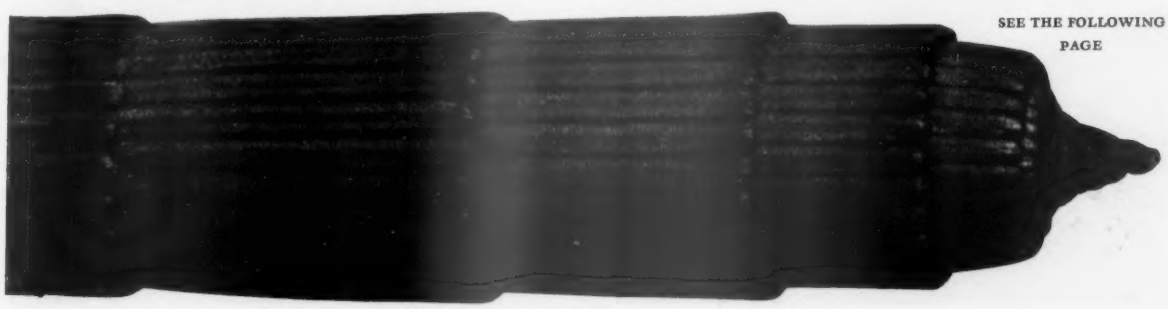
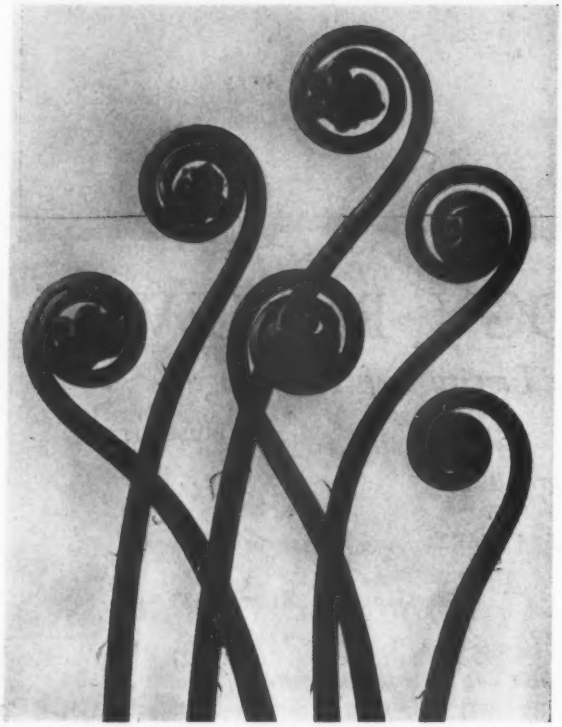




URFORMEN DER KUNST — PROTOTYPES OF ART

PHOTOGRAPHIC STUDIES OF MAGNIFIED PLANTS — PROOFS, PERHAPS, OF OSCAR WILDE'S DICTUM THAT NATURE IMITATES ART

See Preceding Page also

From "Urformen der Kunst" by Karl Blossfeldt, Published by Ernst Wasmuth, A. G., Berlin

THE TECHNOLOGY
REVIEW

VOLUME 33 APRIL, 1931 NUMBER 7

NIAGARA'S WAYWARD YOUTH

A Sheaf of Notes on (1) the History of the Falls; (2) How Nature Helped Build a Railroad in the Gorge; and (3) the Need and Possibility of "Nailing Down Niagara"

BY GEORGE A. RICKER

See page 314

SPECTACULAR breaks in the contour of Niagara Falls, like that which indented the straight face of the American side on January 17, have been occurring throughout the centuries. The hard upper crust of the Niagara limestone strata, about 50 feet thick, is underlaid by layers of sandstone and shale, whose softness makes them particularly vulnerable to the combined impact, absorption and frost actions which occur at the Falls. Because of this geological construction, the cornice of the cataract is constantly being undermined and great masses of the crust crash down from time to time of their own unsupported weight.

Within the memory of living folk the Table Rock on the Canadian side went down, and erosion of the so-called Horse Shoe has changed that crest in my recollection from a graceful curve to a deep wedgelike cut. Because of the much greater volume of water flowing in the Canadian channel, all broken rock has been ground to bits and the depth of the river directly underneath the Canadian Falls is estimated to be as great as the height of the fall itself. The much lighter current over the American side has failed to materially reduce the fallen rock at the base. The presence of this broken rock results in the beautiful ice mountains that make New York Park so spectacular in the winter.

Keystone

ICE IN NIAGARA GORGE. AS DESCRIBED IN THE ADJACENT ARTICLE, IT ALMOST DAMMED THE RIVER IN 1909

As nature counts time Niagara is but an infant phenomenon, 25 to 50 thousand years old. The geologists are agreed that Niagara River began its real work after the retreat of the ice sheet, when the waters of the Lake Ontario basin were drawn down to a level somewhat lower than the present level of Lake Erie. For some thousands of years the total discharge of all the Great Lakes has been through Niagara Gorge, but there is evidence that shortly after the passing of the glacier the upper lakes found outlets through other rivers, and only Lake Erie was drained by the Niagara, then a small stream, very inferior to that of today in its ability to excavate.

To fix the position of the great Falls at any given time by using the present demonstrated rate of erosion is not permissible. The river from the cataract to

THE GREAT WAVE IN THE CENTER OF THIS VIEW OFTEN RISES 40 FEET ABOVE THE ORDINARY LEVEL

the whirlpool is now, obviously, the older section and the Falls may be assumed to have backed up to their present position from the whirlpool in from three to five thousand years. The whirlpool, which marks the turning point in the flow of the river northward some 90° to the right, was apparently formed by the sudden filling up of old St. David's Channel with glacial drift forcing the stream to find a new course.

Thirty years ago, this channel, now scarcely noticed, was plainly marked by the high trestle which carried the electric railroad on the Canadian side around the great pool. Since that trestle has been filled and vegetation has covered the ground, the old preglacial stream bed is rarely noticed unless one's attention is especially directed to it.

The whirlpool itself and the channel from it to Lewiston are picturesque in the extreme — a wonderful job of hydraulic excavation. First, there was probably a series of falls; now there is a fairly uniform grade line with occasional quick drops and beautiful waves, until the river reaches the broad, quiet, navigable waters of the lower river at Lewiston.

Keystone

AFTER THE ROCK SLIDE ON JANUARY 17. THE HUGE PILES OF ROCK IN THE FOREGROUND FELL FROM THE CORNICE OF THE AMERICAN FALLS

MY INTEREST in the phenomena of Niagara Gorge is the result of my experience in building the electric railway which runs from the city of Niagara Falls down into the cañon along the foot of the American cliff. In supervising that engineering job I came to have great respect for Nature's engineering abilities and also found that her capriciousness may sometimes be turned to useful purposes. The building of this railroad was a tough job because of legal difficulties, the inaccessibility of its right-of-way, and the difficulty, under conditions at that time, of getting proper tools and machinery to the work. The company was denied the power of condemnation because it was not, in the sight of the law, a transportation company connecting with other railroads and designed to do business as a common carrier. Without the right to condemn a right-of-way it was found impossible to proceed with the contemplated work as most landowners refused to sell.

This made it imperative to devise a plan whereby connection would be made with the street and steam railways in the city of Niagara Falls and the line run down the bank from the street levels to the river level, passing under the Michigan Central and Grand Trunk railroad bridges in front of their supporting bridge piers. This was to be a standard gauge double-track railroad to be operated by steam or electricity, and to continue along the foot of the east bank of the river to Lewiston, at which point connection would be made with the New York Central Railroad near the steamboat landing, where passengers and goods might be transferred to steamers for Toronto. My survey showed the practicability of such a route and it was adopted at my suggestion. This made possible the organization of the Niagara Falls and Lewiston Railroad Company. Its powers were sustained by the courts in a test case and the work of construction began at the Lewiston end in April, 1893, after several years of negotiation and proceedings to secure the right-of-way.

The first year's work brought the tracks over a distance of five miles, and operation by overhead trolleys was established, using the "lifts" at the Whirlpool Rapids Station as the temporary southern terminal. A second year was necessary

AT THE LEFT ARE THE TWO GREAT BOULDERS DESCRIBED BELOW

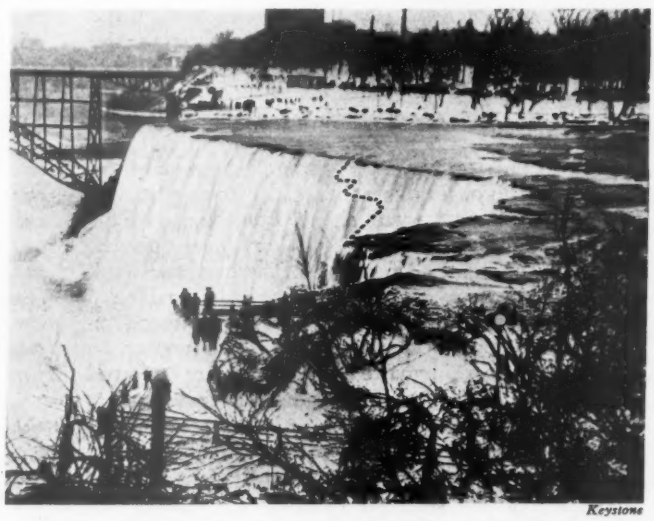
to complete the rock cut and heavy rock-bed construction from the rapids to the city of Niagara Falls, together with some unusual bridge construction in front of the piers of the Michigan Central cantilever bridge, and an under-crossing of the tracks of the New York Central Railroad just before entering the city. Current for operation was purchased, so we had only car barns to build.

The railroad for most of its length rests upon the shoulder excavated from the talus, or débris slope, formed through the centuries by droppings from the walls above. Alongside the upper portion of the whirlpool rapids, in the narrower section of the gorge, the tracks are securely founded upon a rock shelf excavated from the Medina sandstone. For a few years this part of the railroad was operated with a single track on a narrow shelf hugging closely the concave cliff. At one point as a result of some conformation of the bottom of the rapids channel a tremendous stream of water had been discharged against the soft sandstone until the cliff had been cut under many feet. Here the roadbed was formed with great rocks, which, it was expected, would make a permanent structure, but the hydraulic attack was too much and the fill melted away. Then heavy timber cribs, securely bolted and drifted to the bottom ledge were tried and the great stream cut them out easily, although similar cribs had withstood the impact of ocean waves. We almost despaired completely, when something wonderful happened.

For some time anxiety had been felt for the safety of the overhanging strata of limestone 200 feet above the tracks at this point. One fine day when the pilot car ran down the road in the early morning two precious boulders, each the size of an eight room, two-story house, lay peacefully in the edge of the rapids just outside the cribs, and the great hydraulic force which had made the big undercut in the sandstone wall was effectually checkmated by the hard limestone in just the place it was needed. Of course, both tracks had been cut cleanly but the trifling expense of replacing them was cheerfully undertaken. To the railroad company, this was a more important fall of rock than any broken from the cornices of the cataract and was the more thankfully received because it had the good taste to fall in the night.

Lest anyone should fear a recurrence of this drop, I hasten to say that at no other place along the railroad is there a similar condition in the upper cliff, and riding on the gorge railroad is just as safe, and perhaps a little safer, than on most mountain roads because of the regular use of the pilot car and slope watchmen. During the past 30 years no accident has ever occurred by reason of rocks dropping from the cliffs above.

No one knows how long the Sentinel Rock has been there. It is a huge boulder of limestone, originally from the top of the cliff above, and stands outside the tracks at the head of the Devil's Hole Rapids. For hundreds, or perhaps thousands, of years it has watched with stern dignity the irresistible flow of one of the greatest and most beautiful waves in the gorge. This short, quick drop in the grade of the river is all that is left of one of the old steps or minor falls in the post-glacial channel between the whirlpool and Lewiston in ancient days. While the average speed of the current through the whirlpool rapids is about 30 miles an hour, the movement of this graceful wave, just above Sentinel Rock, is two or three times as swift. Here also is the narrowest cross section in



Keystone

THE AMERICAN FALLS AFTER THE JANUARY ROCK SLIDE. THE DOTTED LINE INDICATES THE CONTOUR BEFORE THE SLIDE

STORM KING MOUNTAIN ON THE HUDSON RIVER

the great river through which must pass the water flow of 280,000 cubic feet per second coming over the Falls.

NOT a fall of rock, but an almost unbelievable deposit of ice marked our most exciting experience in the gorge. In April, 1909, when ice in great quantities was coming down from Lake Erie a jam was formed in the quiet waters at Lewiston. It made an almost perfect dam and efforts to break it were for some days quite futile. The waters rose until the ice flow was only 15 feet below the floor of the suspension bridge, just above Lewiston village, and level water extended back stream almost to the famous whirlpool. It was a strange sight, the lower rapids completely submerged, the gorge full above the tree tops with ice and water and our little railroad quite out of sight for several miles.

Some headway was being made in breaking the jam when a second dose of ice came smashing down and things looked bad for the railroad and the suspension bridge. At last the pressure of water became so great that the dam broke and the flood passed out leaving much of the ice piled high above the tracks. With great foresight the superintendent of the railroad had, at the beginning of the jam, lifted the trolley wires and feeder cables well up in the trees on the slopes above the tracks and all the copper was saved.

The next problem was to get through the mass of ice, now pretty thoroughly consolidated, in some places 30 or more feet deep. A steam shovel from Niagara Falls solved the problem and for weeks cars were operated between a through-cut of solid ice. The overhead work was quickly replaced and little damage had been done to the tracks or roadbed. Some of this ice, however, remained beside the tracks until well into the summer. So far as I know, nothing quite like this has ever happened to any other electric railroad; perhaps it could not, as there is only one Niagara Gorge.

During the building of the railroad an experience with rock that rose and fell came near disturbing peaceful relations with our Canadian neighbors. While blasting from the cliffs below the old railroad suspension bridge it was sometimes necessary to drill holes high up on the sides as much as a hundred feet above the grade, in order to make the shelf upon which the tracks were to be laid. The contractors had been repeatedly warned to use small charges, but it seemed so easy and attractive to throw off large masses that the temptation was strong to overlook instructions. One early morning blast, quite evidently larger than permitted, caused a barrage of Clinton limestone fragments to fall in the then town of Clifton across the river in Canada. There was consternation in the town and in the camp. One of our contracting firm, himself a Canadian-Irishman, hurried over to interview the mayor and survey the damage. Little harm was done beyond throwing a scare into some of the unsuspecting inhabitants at breakfast, but the wrathful mayor insisted upon reporting the unfriendly act to the provincial capital. In time the complaint, duly ornamented with much red tape and many seals, reached the State Capitol at Albany and a special Deputy Attorney-General was delegated to make an investigation. All this took many days and when the "Judge" reported back, weeks had elapsed, everything was amicably adjusted, and the war was over. The humiliated but wiser contractor had meantime made his peace with the mayor and assured us, with a touch of true Irish wit, that there would not have been any complaint "at all, at all" if a large rock had not gone through the Canadian custom house from roof to cellar without paying duty.

THE recent crash at Niagara has started reverberations of the old argument: "How long will it take the Falls to reach Buffalo?" a query as sensible as the more ancient one: "How old is Ann?"

Assuming that this old world is going on for at least a few thousand years more and that civilization is to continue, it is unbelievable that the Falls should ever be allowed to reach Buffalo, because among other little things that would happen Lake Erie would be drained. Can it be supposed that engineering science would ever permit such a catastrophe without a struggle?

I had thought I might be the first to suggest that Niagara Falls should be nailed down just where they are, when to my chagrin I found that Professor N. S. Shaler, noted American geologist, had said it more than 30 years ago. In the "Niagara Book," published in 1901, in discussing this very question of what might be done with Niagara Falls, Shaler wrote: "New channels can be excavated which will divert the stream to some point on the line of the cañon where a fresh field of excavation can be provided for the cataract; *or if it seems worth while* (the italics are mine) *an excavation can be made beneath the stream at a point above the falls and a hard masonry support provided for the Niagara limestone, which, as we have noted, forms the cornice over which the water plunges.*

"If we can judge the motives of the future by those of the present," Professor Shaler continues, "the decision as to the eventual fate of Niagara will rest upon economic conditions. It is indeed most likely that the arrest in the southward march of Niagara will be brought about by the diversion of its water to the turbines which drive the dynamos." *(Continued on page 348)*

CAUSES OF MISBEHAVIOR

The Possible Part Played by Disorders of the Ductless Glands in the Behavior Problems of Childhood

By Allan W. Rowe

See page 314

IN RECENT YEARS it is a frequently recorded observation that disorders of the so-called ductless glands seem to be associated with a variety of personality changes. Some of the more optimistic and less critical modern writers carry the implications of this observation to the point where they refer all personality patterns to variations in an intricate and delicately adjusted endocrine concert. Others, with a greater respect for the limitations of factual evidence, in discarding these pleasing and wholly unsupported speculations, none the less trace relationships between disturbed function of single endocrine glands and those types of personality change which may engender a behavior problem.

To the student of the endocrinopathies certain individual personality patterns strongly suggest certain definite disturbances of the level of function in single endocrine structures. The shrill, insistent egocentricity of the ovarian failure, the sullen truculence of the underactive thyroid patient, and the querulous irritability of the sufferer from Addison's disease (the adrenals) are among the better defined.

Needless to say the scientific observer does not erect a diagnosis on the sole foundation of a defective personality; human experience demonstrates daily that such conditions are widely distributed among those possessing completely intact glandular structures. There is, however, a sufficient degree of association to warrant in some measure the more conservative position noted above, and to explain — though not to excuse — the less trammelled speculations of the uncritical.

A logical corollary to the foregoing is the inference that many of the immediate behavior problems of the young, conceivably deriving from similar personality difficulties, may have their origin in constitutional defects of the material body. Such an attitude has at least the sanity of a just recognition that protoplasm is concerned with functions other than that of reproduction, a position sharply at variance with the Freudian concept of all life reduced to a single and very common denominator. If there be constitutional elements, a dispassionate, critical analysis should at least suggest their probability even though the present limitations of knowledge forbid an absolute demonstration.

There are two major factors which come under consideration. First, there is the physical condition which can be expressed in material terms after careful diagnostic study has demonstrated the presence of organic change or of functional aberration. The second is the behavior problem itself which from its very nature is insusceptible today of an equally sharp definition since so many of the composing or substantiating factors are of a wholly subjective character. The final form which an opinion assumes is no more than the integration of a number of largely subjective elements. One aspect of maternal pride, for example, leads the fond parent to stultify her intelligence and declare truculently that her imbecile offspring is as normal as the healthy progeny of her neighbors. Another type of parental reaction leads to the pessimistic designation as feebleminded of the child who is demonstrated by a careful, impersonal, psychometric study to be of average, normal intelligence. It must always be remembered that the history of the individual case is the most subjective and least authoritative of the various evidences marshalled to define the patient's actual condition. Many human qualities come into play in the content of a history. Actual failure of memory which may lead to omissions of vital import, variations in the emphasis laid on the individual item severally by the reporter and the recorder, and frank misrepresentation of facts are all elements tending to produce data both positively and negatively misleading. Another very common source of error is the human tendency to focus on some single outstanding episode and to associate it in a causal relationship with the symptomatic picture. Where such associations derive from an honest lack of analytical perception, careful questioning may establish a chronology that will eliminate the putative causal agent. Less simple is the case where the attribution is disingenuous as in those instances where legal redress for injury is sought. In the case of a child there is a multiplication of difficulties as some of the subversive factors bulk large in the patient's own report, while others operate in both senses in coloring the story of the accompanying parent or guardian.

BEHAVIOR problems as a whole may be broadly subdivided into three major classes. The term in itself is a highly elastic one and the criteria of designation extremely variable. Broadly speaking, however, we have a primary group in which the designation rests upon a definite subversive act directly classifiable as an offense against law. In this category fall such acts as theft, assault, incendiarism, vagrancy, homicide and similar recognized misdemeanors and crimes. A second group comprises those acts which deviate from convention or run counter to the local mores. In this group fall such behavior cases as the sex delinquents, and those whose acts are the outcome of an abnormal psychology. While certain of these may be classified as misdemeanors of an established legal status, the delimitation of their boundaries is less precise and they are far more the expression of local rather than of general interdictions. A mode of dress, for example, which would constitute a flagrant exhibitionism in one community could be compatible with a shrinking modesty in another.

THE ENDOCRINE GLANDS

There are but few of the glandular structures of the body which have been demonstrated to produce a so-called internal secretion which influences the functions of other portions of the body. These few are enumerated below.

Gland	*Position*	*Function*
1. Pituitary (Hypophysis)	In cranium directly behind nasal cavities, in a bony saddle formed by base of skull. Consists of four parts morphologically differentiated. Size of olive.	Plays an important part in the regulation of growth, of development, and of sexual activity. Function of anterior and posterior lobes somewhat understood and several active principles (hormones) traced to each. The *infundibulum* and *pars intermedia* not as yet differentiated functionally.
2. Thyroid	Located in neck just above chest bone. Often enlarged as goiter. Consists of two lobes, each about size of egg, but thinner, and connected by a cross-bar making gland H shaped.	Forms thyroxine, which facilitates oxidative processes in body, and thus regulates general level of metabolism, influencing growth, development and sexual activity. Probably other hormones, not as yet demonstrated with certainty.
3. Parathyroids	Varying number, four being average. Size of pea. On back and top of thyroid gland.	Only function known, to play an important part in regulating certain phases of the calcium metabolism.
4. Islands of Langerhans	Lie scattered about in substance of pancreas in abdomen.	Oxidation, storage and use of sugar. The primary regulator of carbohydrate metabolism.
5. Adrenals	Two glands, each one located immediately above kidney. About the size of two fingers.	Medulla of gland reinforces sympathetic nervous system. Cortex is concerned with various regulatory processes, not understood.
6. Gonads	Genito-urinary tract.	Female glands highly important after maturity. Among the active regulators of metabolism during all of adult years. Male glands important in childhood; apparently no endocrine activity after maturity. Probably show properties similar to female glands in childhood.

The pineal, the thymus, and the spleen are possible organs of internal secretion although their status is a dubious one. Endocrine activities may exist in other portions of the body, but evidence is very incomplete and their inclusion in the ductless glandular system is in largest measure speculative.

The third and certainly largest group of behavior problem cases are even less well defined than the foregoing and many times depend upon a somewhat nebulous indictment that derives its real content from the reporter's own interpretation of the act. In such a group fall the a- and anti-social children, the morose, the disobedient, the egocentric and the cruel. Here ordinary standards of behavior influence unduly the classification of the child in both a negative and a positive manner. It is safe to say that many of the problem children falling in this group would be promptly eliminated by a broader and more genial outlook on life on the part of the elders, and equally, that many other children would be placed in this category by the community at large though reported by the parents as wholly normal and well-behaved children. Since a subversive act may be the major feature of one behavior problem, while a mental attitude or reaction constitutes the basic factor of another, a clear-cut definition is at best extremely difficult if not impossible.

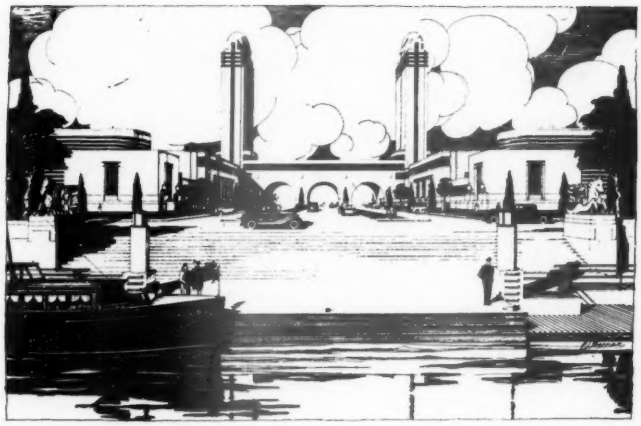
Analysis of attendant circumstances as determining standards constitutes yet another highly important factor of which due cognizance can be taken only in the rare case where it has been possible to compile a complete, authoritative, and intelligent social history. For example, the child born of criminal parents and trained from earliest years to steal, must be differentiated sharply from that other child, the offspring of intelligent and highly ethical parents, whose upbringing has been exemplary and yet who ultimately becomes a thief. The overt act in the two cases is identical, the contravention of correct behavior the same, but the underlying mechanisms in the two instances are sharply divergent.

Enough has been said to indicate the relatively indeterminate character of the so-called behavior problem in a majority of children concerning whom the report may be made. Even the most searching enquiry may fail to bring to light some very important contributory factor in the determination of the final behavior pattern, a knowledge of which would influence profoundly the final interpretation of the underlying mechanism. In the present consideration one is constrained to accept the designation of the reporting agency, be it physician, social worker, guardian, or parent, recognizing the varying degrees of objectivity with which the individuals in these several groups approach the problem. In the present survey these variables detract from the authority of the final statement and due allowance must be made for this in any generalization.

THE major thesis, as indicated in the introduction to this paper, was an attempt to ascertain if there were demonstrable constitutional factors in a group of children presenting the common designation of a behavior problem. The material selected for this survey was a series of 4,000 consecutive cases all of whom had received a careful and comprehensive diagnostic study. From this initial group the records were selected of all patients who were less than 17 years of age. This line of demarcation is an arbitrary one, but experience has shown that the child who has not matured before the seventeenth birthday is to be regarded as falling outside the somewhat elastic zone of the normal as related to this particular attribute. The selection yielded a group of 650, the ages ranging from four to (*Continued on page* 353)

The Regional Survey of New York

RIGHT: AN ARTIST'S CONCEPTION OF A FORMAL ENTRANCE TO THE FUTURE CITY IN THE HACKENSACK MEADOWS (N. J.)



Courtesy New York Times

BELOW: THE PROPOSED AREA TO BE RECLAIMED IS SHADED. IT IS APPROXIMATELY TWICE AS LARGE AS MANHATTAN ISLAND

A CITY OF TOMORROW

The Gigantic Project to Reclaim the Hackensack Meadows (N. J.) and Build a Great City There

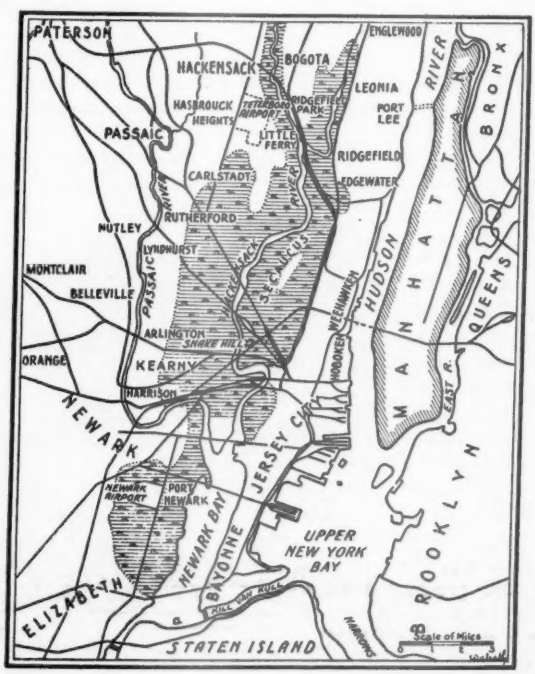
By William P. Cutter

See page 318

THE traveler leaving New York City for the West over the Pennsylvania, Lackawanna, or Erie Railroads finds after a few minutes that his train is passing through a desolate region of treeless marsh. There is little to relieve the monotony of the landscape except a few dingy manufacturing plants. To the north and south there is nothing but this dreary waste; two sluggish rivers are crossed, and there are numerous sidetracks with freight cars on them, but there are no inviting homes, no lawns or gardens, no cultivated fields. This is the dank, forbidding Hackensack Meadow region.

The meadows stretch many miles toward the northeast with only a few isolated minor elevations. There are in all about 45 square miles of marsh, an area much greater than that of the island of Manhattan, which is only three miles distant from the meadow's eastern boundary.

Because the region is easily accessible from New York City by rail, motor, and bus, men of foresight have long recognized its potential value. Indeed, it is only a few miles from the site picked out by Alexander Hamilton, the father of American manufactures, for a great national industrial center. He recommended the establishment of a city at the falls of the Passaic. The Society for Establishing Useful Manufactures, the first incorporated society in New Jersey, was founded at his suggestion to carry out the idea and it employed Major L'Enfant to draw plans. It is said that he drew streets for the New Jersey city 200 feet in width, stretching alike over steep hills and over deep gorges. It was a magnificent plan, unfortunately never carried out. The numerous industries dwindled down to one cotton mill (the first outside of New England), and this burned down after a few years. The city in the meantime had acquired other industrial plants, and the result is the busy metropolis of Paterson.



Several official reports have been made from time to time advocating the reclamation of this vast meadow, but until recently the whole project has seemed to be such a stupendous and expensive undertaking, involving such intricate questions of law, engineering and finance, that no plan was broad enough in scope or sufficiently developed in detail to assure probability of action.

The Regional Survey of New York

AN IDEAL INDUSTRIAL SECTION ENVISIONED FOR THE REGIONAL PLAN OF NEW YORK

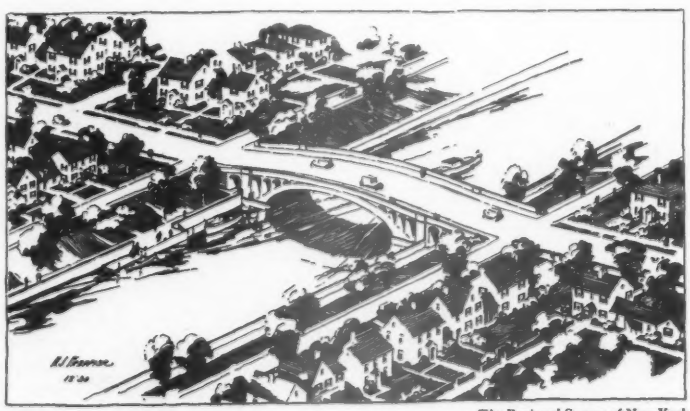
Several years ago, however, a body was constituted by private initiative to undertake the enormous task of making a general survey of the whole metropolitan region of which New York City is the center. This body was luckily free from political control, was adequately financed by a grant from the Russell Sage Foundation, and its personnel was of such a high type that complete reliance could be placed on its altruistic attitude. Its aim was to develop something that would make this region not only the most prosperous community in the world, but the best community to live in.

The result of several years' work on the part of this organization is "The Regional Survey of New York and Its Environs," a series of volumes replete in detail, representing the most extensive survey ever made of a metropolitan area anywhere. After the first fact-finding compilation, two other volumes were begun, outlining a comprehensive plan for the development of the whole region. One volume has been issued, stating this plan graphically; the other is ready for publication.

One of the major projects given the fullest consideration in both of these studies is for a systematic utilization of the whole Hackensack Meadow region. The Regional Plan does not limit its suggestions to the development of a purely industrial district, although previous studies had been limited to this narrow conception. The meadows become, under the Regional Plan, a complete new city, including not only a great industrial center, but a deep-water port, railroad terminals and classification yards, highway systems, park systems, recreational areas, airports, and a great residential district. Of course, the Board can do no more than plan for such a development as it has no authority to execute such a prodigious project. Indeed, up to the present writing, no such authority has been constituted, but, as we shall see later, a movement is on foot to organize such a body.

The Hackensack Meadow region extends northeasterly from Newark Bay, a distance of approximately 12 miles, with an average width of four miles. On the east are the hills on which Jersey City, Union City, and other cities are built, while directly east of these hills is the Hudson River. On the west are Newark, Arlington, and Rutherford; and to the north is Hackensack, from which point the tortuous, sluggish, muddy Hackensack River meanders down to Newark Bay, where it joins the Passaic River. At the southern extremity of the meadows are the sites of those terrible examples of industrial towns, Harrison and Kearny.

THE meadows average a height of only four feet above high tide, and are often covered in times of flood. In the center is the eminence of Snake Hill (very suggestive in name), from which a low ridge extends northeastward for about three miles. The whole region is a breeding ground for a particularly vicious variety of mosquito, so that one of the most potent arguments for the development of the whole region is that it would mean the



The Regional Survey of New York

A SYSTEM OF CANALS AND PARKWAYS ADD TO THE BEAUTY OF THE RESIDENTIAL SECTION OF THIS WELL-PLANNED CITY

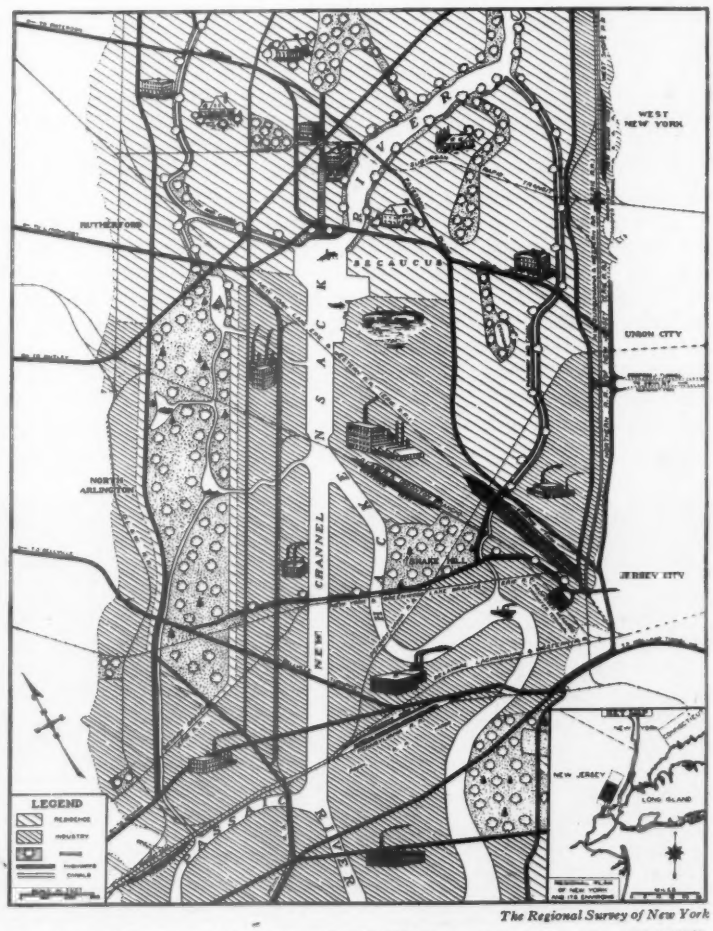
control of this pest. Frogs and snakes are also abundant. The vegetation is largely coarse sedge. The meadow serves one useful purpose in its upper reaches: it is a good place to get rid of worn-out automobiles. The Regional Plan advocates the division of this region into three great sections. The southernmost would include the port, with a series of wharves and docks, and a ship canal made by straightening the Hackensack River, dredging it, and having a large turning basin at the northern end. Here warehouses would be erected, and ocean and railroad terminals coördinated. Along this canal and subsidiary side canals would be sites for industrial establishments, with railroad sidings and highway connections, so that raw materials might arrive by water, rail or road, and finished products could be shipped by one of these same methods. It would be quite possible to so group these industrial plants that each major industry would occupy a certain area.

North of this industrial area would be a second district devoted to recreation. Here there would be sites for great athletic fields and stadia; buildings for international expositions and for industrial museums; golf courses, tennis courts and swimming pools; landing fields, hangars, and garages for the bus lines which would serve the region. The western border of this second region would be devoted to a park, with an area larger than Central Park, with wide roads and narrow bridle paths; arboretums, formal gardens and greenhouses; a zoölogical garden and an aquarium; playgrounds for children, rest houses and restaurants; comfort stations and shelters.

The northern third of the region would be devoted to residential towns which the Regional Plan proposes to develop by a community village system, such as has characterized some of the other residential developments by the Russell Sage Foundation. By this system, community life is fostered, open spaces are provided, and, by so placing the main boulevards that they are outside the residential centers, safety from automobile traffic is secured. There is no reason why homes in such a section should not equal in attractiveness the suburban residences in the Jersey Hills. Of course, two questions at once arise — whether the space thus divided will furnish sufficient housing for the industrial workers in the manufacturing section, and whether they could afford to live under such favorable conditions.

The whole region, of course, would require very careful planning of its highway system. There would be of necessity a system of north and south roadways, now entirely non-existent. Relocation of railroads would be necessary, and a connecting railroad or railroads would have to be constructed. Bridges over the Hackensack and the cross canals would be required, and some of the existing bridges would need to be redesigned to allow the passage of vessels. Access to the open ocean might be, as at present, through the Kill van Kull at the north of Staten Island, or by the Arthur Kill to the west of that island, but it is more probable that the final plan would take advantage of the low spot in the Bayonne Peninsula at the point where the Morris canal now passes and the Lehigh Valley Railroad turns to the west to cross Newark Bay.

SUCH is, in general, the Regional Plan suggestion for the development of this region. It is well worked out, but there are points open to criticism. With this plan before it, the New Jersey Meadows Reclamation Commission has submitted to the Legislature in 1930 and 1931 its own plan. It differs from the Regional Plan in some very essential matters. In the first place, the Hackensack meadows are not the only ones around Newark Bay, for Newark itself has some meadows, and it has developed its own port. It can hardly be conceived that any plan for the development of this meadow region which did not take into consideration this very live and progressive city would receive acceptance. Again, the Regional Plan did not involve the establishment of a great ocean port independent of the Port of New York. If, however, the Newark Bay ports are to be simply (*Continued on page 348*)



The Regional Survey of New York

THIS MAP SHOWS THE BALANCED APPORTIONMENT OF THE LAND FOR INDUSTRY, RESIDENCE, RECREATION, AND BUSINESS USES

THE TREND OF AFFAIRS

Clinical Notes on Aeronautics

IT IS being bruited abroad that the aeronautical industry suffered from the depression in 1930 as severely, if not more severely, than most American industries. What are the facts? The large holding companies specializing in aeronautical securities, of course, suffered further depreciation in the value of their holdings due to further depression in the stock market. The manufacturers of commercial planes were completely paralyzed, and the sales in this class that were made were largely disposals of the excessive production of 1929.

Local operating companies at commercial or municipal airports likewise suffered heavily in their operations. Two general classes, however, showed growth and prosperity to a degree almost sufficient to make the year at least passably satisfactory for the industry as a whole. One was the continued production of aircraft for the Army and Navy carried on by a few large factories specializing in that field, and the other was the remarkable development in the field of scheduled transportation.

The general features of the past year were the continued development of mail routes, the extension of passenger services, and the strengthening effects of the Watres Act, which enabled the Post Office Department to contract with the passenger lines for the carrying of partial cargoes of mail on a space basis; the purely mail lines also being changed to the same basis of payment from the former one based on poundage of load carried. Through this mechanism the air mail system, which was essentially a single transcontinental route supplemented by feeder lines, has now been replaced with a network of three transcontinental lines and connecting links, which in general offer passenger service as well as mail. The lines which had been inaugurated the previous year offering combined rail and plane passenger facilities continued to operate, in most cases, on a substantially more efficient foundation than during 1929. Entirely new in the field were the developments of short and middle distance lines, namely, the air ferries which operate across San Francisco Bay, and the already famous New York to Washington line which is operated every hour on the hour. This last line has been achieving remarkable successes, carrying as many as 5,000 passengers a month, and similar services are being inaugurated in the Middle West and are planned for other regions.

The general statistics on transportation for 1930 are remarkable for two reasons: one for the sheer bulk of mileages achieved, and the other for the almost incredibly high safety record for its operations. Never again will there be the least excuse for the generally credited statement that the United States is lagging behind Europe in any phase of air transportation. Scheduled air transportation operations in the United States last year reached a total of 33,403,000 airplane miles. The rest of the world together, as closely as can be estimated, turned in a corresponding figure of about 31,000,000 miles. In passenger mileage the American figure was the surprising one of 108,000,000, while the other countries together totaled somewhere in the neighborhood of 60,000,000. In express and mail traffic the United States and the entire world both reached a little over 3,000,000 ton-miles.

Certainly no less gratifying is the outstanding safety record. During the past year, in spite of the unusually large totals of operations, there were only 26 fatalities on the scheduled air lines in the United States. Never has anything of this sort been previously achieved. The Imperial Airways, which holds virtually a transport monopoly in England, operated during one period of three years without a fatality, but the total flying during that period was roughly about 1/10 of that done during the past year in the United States. The important figure, of course, is that based upon passenger miles, and the

Courtesy Republic Steel Corporation

LAYING A NATURAL GAS WELDED PIPE LINE

figure achieved was 0.24 passenger fatalities per million miles. Stated more graphically, any one passenger's chances of meeting fatality on an American air line is roughly once in four million miles of travel. It has been pointed out by Edward P. Warner, '17, Editor of *Aviation*, that the above record would have been even more remarkable except for a number of severe accidents which occurred in January, 1929, and that if the 12 months between February 1, 1930, and January 31, 1931, are taken, there were only eight passenger deaths, or a figure of almost 15 million passenger miles per fatality.

Some types of statistics accumulated over a short time are open to the suspicion of mere chance. If flying conditions in the United States were the same as they were five years ago, it would be easy to discount many of the above figures, especially those on safety. Such, however, is not the case. Numerous and complete analyses of airplane accidents seem to allocate their causes into four main divisions: those due to error of judgment and inexperience of pilots; those due to airplane or engine failure; those due to weather; and those due to being forced to descend on unsuitable areas, after one of the two preceding causes. The United States has made remarkable progress in overcoming these difficulties. There is no cure for inexperience except flying and as can be seen above, we do more flying, both scheduled and unscheduled, than the rest of the world put together. The average transport company at the present time would hardly consider employing a pilot who had not at least 2,000 hours of flying to his credit. Five years ago there was hardly a score of men in the United States outside the services with such totals. Today there must be four or five hundred. The Department of Commerce has, through its licensing and inspecting activities, made tremendous strides toward the elimination of engine and plane failures.

The design of the plane is carefully checked against rigid standards, its manufacture is supervised, and its operations must conform to certain laws of inspection and control. Nothing has been done as yet toward the controlling of weather, but a great deal has been done in the way of weather reports, navigation facilities, and radio communication. The Weather Bureau now operates about 400 special airway weather stations and the Department of Commerce broadcasts complete radio reports every hour. Almost every transport plane in the United States is now equipped with radio receiving apparatus and the vast majority of them are equipped with two-way radio. The radio beacon has been installed on most of the airways of the United States and has proved a great help.

In the last field, that of airports, great progress has been made. The United States now has about 1,500 airports. One possible standard which has been proposed is that there should be at least one field for every 600 square miles of area. Seven eastern states have already achieved this. Another seven are in the next lower group, that is, having one for every 1,200 miles, and many other states have almost their full complement of airports. For example, the aeronautically advanced state of Kansas with its prairies has little need for specially prepared and recognized intermediate landing fields, which types swell the total for the other states, and therefore does not receive its full credit.

The governmental agencies, the executives and personnel of the air lines, and even the investor whose funds have made 1930 American air transportation possible can be proud of their success.

Galloway

EIGHTY-FIVE STORIES ABOVE THE STREET. FINISHING NEW YORK'S EMPIRE STATE BUILDING

Chemicals from Coke

THERE truly seems to be no limit to the variety of organic substances which may be synthesized now or in the future by simple processes from the elements or from simple, cheap, and abundant materials. From carbon monoxide (or dioxide) and hydrogen, at 300–350° C. and a pressure of about 3,000 pounds per square inch, it is now possible to produce synthetic methanol at a market price which is about one-half that of a few years ago. Approximately seven million gallons were thus produced in this country in 1930, about as much as that which came from the wood distillation industry.

Under slightly different conditions the same materials may be made to yield the higher alcohols — ethyl, propyl, and butyl; and it is reported that plants are now practically ready to commence the manufacture of higher alcohols, probably isobutyl alcohol, by this method. Under other conditions it is possible to convert carbon

monoxide into hydrocarbons suitable for motor fuel, into aldehydes, esters, fatty acids, and possibly artificial rubber. If the necessity should ever arise, it will no doubt be possible to manufacture edible fats from coke.

Practical syntheses, not involving high pressures, have been in use for some years for the production of ethyl alcohol (good natured alcohol), acetic acid (the acid of vinegar), and acetone (which finds wide use as a solvent) from acetylene and, therefore, from calcium carbide or from limestone and coke. The cracking of petroleum to increase the proportion of it which shall be available for motor fuel leads to the formation of ethylene as a by-product and this by practical syntheses is now being converted into a variety of useful substances. One of these is ethylene glycol, which is used in making dynamite and is familiar to automobile users under the name of Prestone. The other is di-ethanol-amine, which is used in the soap industry and as an acid absorbent.

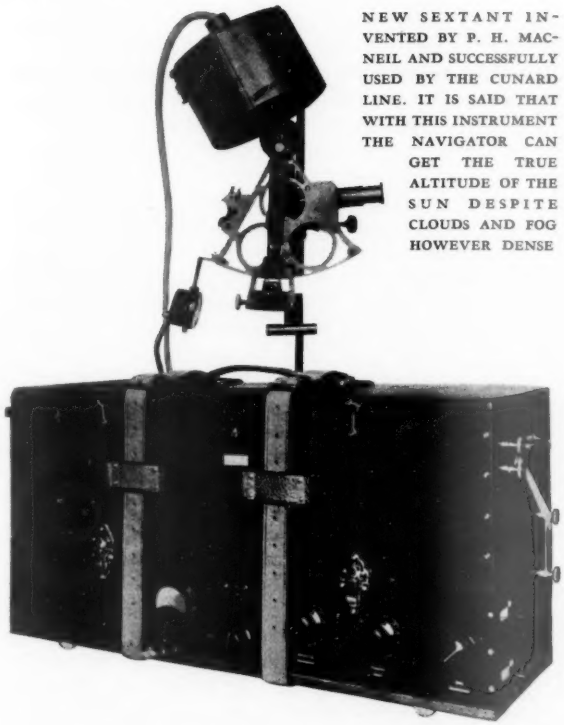
And this is by no means the end of the story. The vast and gratuitous energy of the tropic sun still remains to be exploited, both as a source of heat and mechanical energy and as a source of chemical energy available for the syntheses which are now carried out only by living plants.

High pressure syntheses depend for their success upon the fact that the products of the chemical reaction occupy a smaller volume than the raw materials. Since the formation of the products is accompanied by a diminution of volume and since an increase in pressure tends to produce a diminution in volume, an increase in pressure tends toward the formation of the products. At a given temperature the equilibrium between the simpler reacting materials and the more complex products which they form — or between the heavier products and the lighter reacting materials into which they break down (for the reactions are reversible) — is such that high pressures favor the heavier materials and low pressures the lighter ones. The larger molecules, which form at one temperature if the pressure is high, decompose at the same temperature into smaller and lighter molecules which occupy a greater volume if the pressure is low.

Frolich's (Per. K., '23) success in the study of high pressure synthesis has been largely dependent upon his recognition of the importance of this bit of theory. The reversible reaction of formation-decomposition is one reaction. Catalysts hasten it in both directions but do not alter the conditions of equilibrium. A catalyst which will lead at high pressures to the formation of the

Galloway

PROBLEM IN DESCRIPTIVE GEOMETRY OR HOW A CAMERA WAS MADE TO SEE A COAL-CONVEYING SYSTEM IN STAMFORD, CONN.



NEW SEXTANT INVENTED BY P. H. MACNEIL AND SUCCESSFULLY USED BY THE CUNARD LINE. IT IS SAID THAT WITH THIS INSTRUMENT THE NAVIGATOR CAN GET THE TRUE ALTITUDE OF THE SUN DESPITE CLOUDS AND FOG HOWEVER DENSE

desired product will lead to its decomposition at the same temperature and at low pressures. By studying the effect of various catalysts at atmospheric pressure upon the decomposition of a substance, Frolich has been able to determine what their effect upon its formation at a higher pressure would be. By studies upon pure substances suspected of being intermediate between the raw materials and the product, he has been able to gain an insight into the course of stepwise reactions.

Metal Foils

OUT of the art of the goldbeater, whose shimmering gold leaf decorated the sarcophagi of the ancient kings of Egypt, has grown the modern metal foil industry which now produces thin sheets of various metals for an ever-increasing variety of uses, both artistic and utilitarian. Homer sang of the beater and his gold leaf; a modern singer with Homeric tastes would tell not only of gold, but of delicate leaves of silver and copper, brass and lead, and aluminum.

The modern foil industry has developed from the production of lead for paints, one of the first modern industrial foils being a thin strip of lead foil useful in decorating Christmas trees. The industry, whose earnings last year amounted to more than $300,000,000, now makes metal foils which are used for wallpaper, for insulation, and for wrappings about cigarettes, candy, and various food products.

Other practical applications in recent use are for electric motors, the construction of electrical apparatus, including condensers, and in the radio industry. As an insulator for refrigeration, the bright metallic surface of the foil reflects heat and retains cold. As a covering for boilers, it reflects heat back into the boiler, thereby increasing its efficiency. In this field foil has become so important that it may replace asbestos and other boiler insulating materials in many instances because of its durability, light weight, and low cost. Another recent use is in the development of a photographic flash lamp which employs aluminum foil in the production of a brilliant light of great actinic strength.

The classification into which the modern foils fall is between leaf and sheet metal. That in most common use is tinfoil, which consists chiefly of lead, and is the material used in wrapping cigarettes, tobacco, and confections. It was early discovered that foil, by its contrast or peculiar brightness, heightens the attractive qualities of various objects. In the arts, for instance, thin sheets of metal, Dutch foil, are widely used as a backing for artificial gems or for increasing the natural luster in stones. Much of this foil is silvered copper, a combination often used in the production of mirrors and various ornaments.

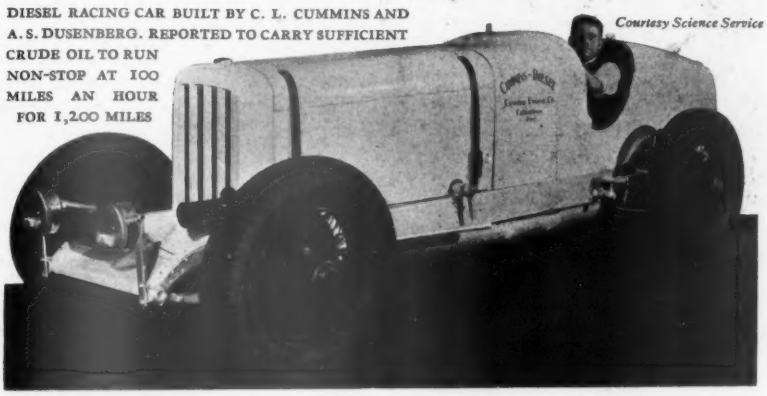
The Japanese have produced variegated foils which give the effect of "damaskeening" and which are produced by placing together thin plates of different metals, including gold, silver, copper, and alloys. These thin sheets are soldered in a particular order, and the pattern is then hammered on the edges. When rolled or hammered into the form of foil, the result is very beautiful.

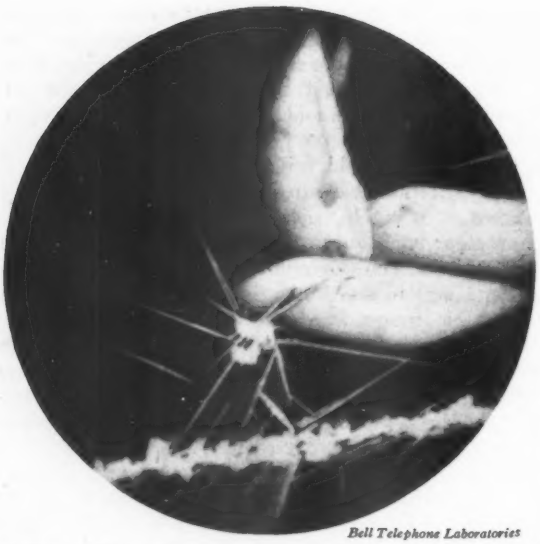
In spite of the fact that most modern foils are produced by machinery, the goldbeater still reigns supreme in his ancient art of producing gold leaf by hammering the metal between goldbeater's skins. The art probably originated among the nations of the East, where the use of gold is evident from the most remote periods.

The minimum thickness to which gold can be beaten is not known with certainty. As early as 1621 records show that from one ounce of gold was produced more than 105 square feet of leaf. As time passed, the amount of leaf from a given quantity of gold increased to as much as 300 square feet to the ounce. The malleability of gold is greatly diminished by the presence of other metals, even in minute quantity. The modern "book of gold" containing 25 leaves, each 3¼ inches square, equals an area of 264 square inches and weighs between four and five grains.

DIESEL RACING CAR BUILT BY C. L. CUMMINS AND A. S. DUSENBERG. REPORTED TO CARRY SUFFICIENT CRUDE OIL TO RUN NON-STOP AT 100 MILES AN HOUR FOR 1,200 MILES

Courtesy Science Service





Bell Telephone Laboratories

ABOVE: STEEL MAGNIFIED 5,500 TIMES BY SUPER-MICROSCOPE DESCRIBED ADJACENTLY. BELOW: STEEL MAGNIFIED 175 TIMES

BELOW: A NEEDLE OF MARTENSITE, AN EXTREMELY HARD MATERIAL FORMED BY TEMPERING. MAGNIFIED 3,230 TIMES

Super-Microscope

SCIENTIFIC progress in many fields has largely become dependent upon progress in the design of research tools and instruments. The Review reported last month the development of a new spectroscope which will help in pushing a little further into the unexplored realms of atomic physics. The improvement of another optical instrument for research has lately been announced — a refinement of a scientific instrument which will lead inevitably to scientific progress. We refer to the super- or ultraviolet microscope designed by Dr. Francis F. Lucas of the Bell Telephone Laboratories. This new microscope employs ultraviolet and is capable of magnifications as great as 6,000 diameters — six times greater than any previous instrument.

Some 50 years ago the late Dr. Ernst Abbe, great optical authority of the Zeiss Laboratories in Germany, came to the conclusion that the wave lengths of visible light were too long to produce small details. Later, scientists of the Zeiss Laboratories constructed a microscope which utilized entirely the short invisible ultraviolet rays. For some reason the importance of this work was not realized at the time. Dr. Lucas, seeking an instrument that would reveal the smallest detail possible, turned to the idea of the Germans and designed the ultraviolet microscope which has recently been announced. Dr. Lucas is a metallurgist, and it was for studying the structure of metals that he designed this new instrument. It will have other uses, however, and is expected to open up new fields of research in biology. Under its keen eye a single cell, the smallest of living units, is expected to be revealed in minute detail.

Some conception of the great possibilities of this super-microscope is indicated by the fact that, in addition to giving magnifications as high as 6,000 diameters, it is capable of photographing on focal planes spaced as closely as 100,000th of an inch.

In its scrutiny of metals, the new microscope has already revealed very interesting conditions. (See adjacent illustrations.) The surface of a piece of steel magnified 3,500 times showed, for example, a network of fine cracks, which may indicate the cause of structural breakdowns, now called "fatigue." These infinitesimal cracks are produced by the heat treatment of the metal, and with the aid of Dr. Lucas' instrument, science may go far toward solving the mystery of why metals fail. Out of such studies are likely to come a revision of existing methods or entirely new methods of heat treatment.

The new microscope, because it employs as its light source the invisible ultraviolet, reveals what it sees, not to the human eye, but upon a photographic plate. Its most accurately ground lenses are of quartz, which transmits the ultra-violet light, the source of which must be very intense. The light in the instrument designed by Dr. Lucas is obtained by a cadmium spark.

Because the objects studied under this instrument cannot be seen by the human eye, the operation of the microscope demands a special technique. The object, for instance, is brought into approximate focus in the usual manner, and it is then viewed by means of what is called a "searcher eyepiece," a bit of fluorescent glass upon which the invisible light produces a visible image. This image is in turn brought very nearly into focus by further manipulation, which requires the most sensitive adjustment. The plate holder is then

put into place and four photographs are usually taken, each one an exposure of slightly different focus. This technique usually produces at least one photograph in which the detail is recorded in sharp outline.

Food Technology vs. Gastronomy

"Dainty sauces are the life, the nobility of famous dishes; taken alone, the former would be nauseating, the latter plebeian."
—George Meredith

FOOD technology has been and is of enormous value to man, but in desperately pursuing its fruitful ends we have shown a tendency toward ignoring some of the more artful and exalting aspects of gastronomy. In our chase after the almighty vitamin we have almost forgotten the art of combining and embellishing food. To paraphrase La Rochefoucauld, eating vitamins is a necessity, but eating intelligently is an art.

It is not an art to eat only with an eye toward maintaining the calcium content of one's bones, or toward preventing rickets, or toward acquiring the proper calory input. To eat with only these things in mind is like painting a picture wholly by the laws of physics, and excluding aesthetic considerations. The result is bound to be drab and barren, hardly inspiring even to physicists.

If we wish to design a great building which men will admire and approve (if only as an advertisement) we do not leave it entirely to a structural engineer; to his necessary work we add the architect to humanize the structure and make it a thing of beauty. Even our great bridges are no longer mere exercises in applied mechanics; the engineer designs them to stand up and the architect, without decreasing the factor of safety, adds his touch to make them nobly beautiful in their strength, structures not only to support man, but to stimulate and satisfy man's aesthetic hunger.

But we are in danger of being less civilized in our eating, utilizing only the mundane science of the food technologist and ignoring the art of the cook. The situation is reflected in current food advertising; there is an unappetizing insistence upon dubious scientific factors, and almost no emphasis on the cunning mixing of ingredients to give the final dish the same harmony that painters give to colors. The situation has reached the stage where the man in the street can talk glibly of vitamins and calories but college graduates know nothing of *bouillabaisse*, or the sauces Béchamel or Soubise. We must give the food technologist his due, but in so doing we must recognize that he cannot administer to the higher faculties of the palate and pylorus.

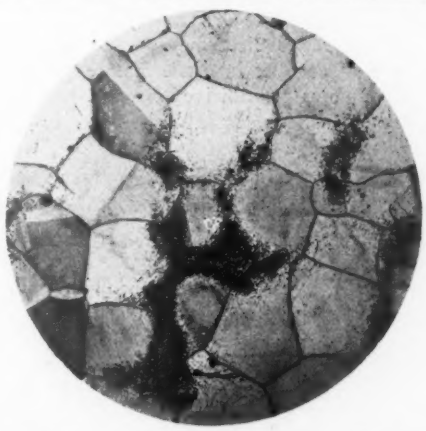
The Height of Ships' Masts

WHETHER or not a bridge is to be built across New York's teeming harbor at a cost of $180,000,000 depends, for the moment, on a matter of a 25-foot difference in the height of a ship's mast. The proposed bridge, a single span of 3,240 feet, would connect Manhattan Island and New Jersey at 57th Street.

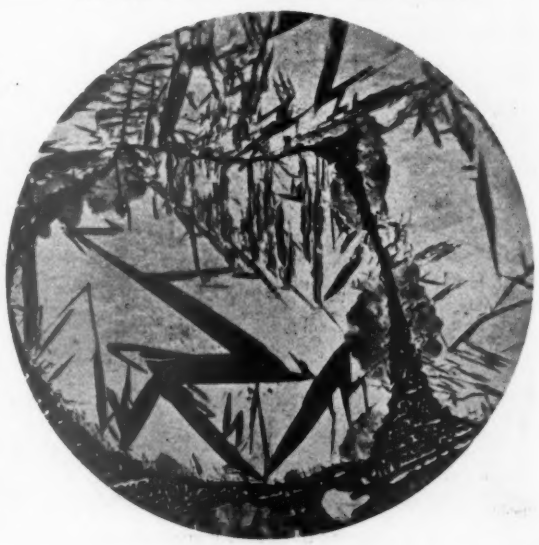
As originally designed the bridge would have a clearance of 155 feet above the Hudson River. The War Department regulations, however, arbitrarily demand a clearance of 200 feet. A second design increased the clearance to 175 feet, the 20-foot difference adding $20,000,000 to the estimated cost

Bell Telephone Laboratories

FLAKY NEEDLES OF MARTENSITE, SHOWN TO BE A PRECIPITATION OF IRON CARBIDE. BELOW: STRUCTURE OF MANGANESE STEEL



BELOW: HIGH-POWERED STUDY OF AUSTENITE CRYSTAL SURROUNDED BY A DARK MATRIX OF IRON CARBIDE



for construction, but the War Department holds to its original decision. On the other hand, engineers claim that only three United States ships and 19 commercial vessels in the world have masts higher than 175 feet. Furthermore, they direct attention to the fact that the proposed site is well above the docking facilities for the largest ships. As for naval vessels, it is pointed out that to reach the Brooklyn Navy Yard, one of the most important on the Atlantic seaboard, vessels must pass under Brooklyn Bridge, which has a clearance of only 133 feet.

This raises the interesting question: Why ships' masts? now that steam has banished large sailing vessels from the seas. The answer is, to support radio masts to hold the antennae well above the smoke and fumes that roll from the great funnels, and as derrick masts for handling cargo. But even radio engineers, while claiming more effective communication if aerials are clear of smoke and fumes, agreed that telescopic masts, with which some ships are already equipped, solve the problem. So, construction of this great bridge, with double decks for 20 lanes of vehicular traffic on the top deck, 12 railway lines and moving sidewalks for pedestrians on the lower level, depends on whether the War Department will reduce its clearance to 175 feet above water level. To build a bridge to fit their present requirements would necessitate extension of the approaches into the most expensive section of Manhattan at a prohibitive cost.

The *Majestic*, queen of the White Star fleet, has masts 221 feet high; the *Berengaria* 215½ feet; the *Bremen*, *Europa*, *Olympic*, and *Leviathan* all rise to a height of more than 200 feet. The liners *California*, *Pennsylvania*, and *Virginia* have telescopic masts that can be lowered to 128 feet. As for naval vessels, the only ships halted by a 175-foot clearance would be the *Omaha*, *Lexington*, and *Saratoga*, the first with masts 193 feet high, and the other two 185 feet above the water-line.

Wolf: Courtesy The Seven Seas

BRIDGE OVER RHINE RIVER AT COLOGNE

The Bridge-Builders

AN index of American engineering genius can be found in the multiplicity of bridges that knit together our country. From rude structures arching puny brooks to colossal suspensions thrown across broad rivers and bays, they collectively represent a boldness and ingenuity incomparable in the history of bridge building. Symbols, they are, too, of American unity, democracy, homogeneity. The American continent, reticulated with streams, crenulated with bays, a patchwork of land, is being stitched together, physically, politically, and socially by these many structures.

A glance over the record for the past few years yields convincing evidence, while present projects and future plans clinch the point. The Ambassador Bridge with its 1,850-foot suspension between Detroit and Windsor, Canada, is in use. The Kill van Kull, with its steel arch of 1,652 feet, the longest in the world, connecting New Jersey and Staten Island, is to be opened for traffic by the end of this year. So is the stupendous Fort Lee-Hudson River Bridge, nearly twice as long as the Ambassador. Construction is to start this spring on an even longer suspension bridge — a span over the Golden Gate 4,200 feet long — and the location has been selected for another great structure nearby, the San Francisco Bay Bridge to Oakland, to cost $12,000,000. The Martinez-Benicia Bridge of the Southern Pacific Railway across Suisun Bay, costing a like amount and made notable by its heavy earthquake-proof design, was opened November 1. Other bridges recently completed include:

1. South Shore at Montreal. Contains 1,097-foot cantilever in its two miles of length.
2. Columbia-Wrightsville over the Susquehanna. Twenty-eight arches, longest of its type.
3. Mid-Hudson at Poughkeepsie. Suspension 1,495 feet long.
4. At Vicksburg, a combined railway and highway bridge with cantilever span of 825 feet.
5. A continuous truss of two 628-foot spans over the Mississippi at Quincy, Ill.

In addition the following have been started or are being planned.

1. Four structures at Pittsburgh: the Tenth Street suspension, the McKees Rocks and West End Steel arches, and the George Westinghouse concrete arch. The last of these, with a main span of 460 feet, outdistances anything of its type.
2. Triborough over Hell Gate.
3. Waldo-Hancock, high-level 800-foot span suspension over the Penobscot River.
4. Belt Railway and the Hero-Hackett at New Orleans.
5. The 750-foot suspension at Toledo, Ohio.

6. Two concrete arches over the Niagara at Tonawanda, N. Y.

7. Cantilever crossing of the Hudson at Catskill, N. Y.

8. The Arlington Memorial Bridge over the Potomac with double-leaf bascule span.

9. St. Johns over Willamette River at Portland, Ore., with a record-breaking span of 1,207 feet for rope strand type of cables.

Public vs. Private Financing of Bridges

INCREASES in the number of highway toll bridges in this country in the last few years have been so rapid that up to last summer nearly 300 were in operation and some 50 more will soon be added. These will bring the country's total investment in such structures to well above a billion dollars, a sum exceeding the present combined wealths of Delaware and Nevada, and almost equal to the entire pre-War national debt of the United States.

Toll bridges privately operated are now the predominating type but this bids fair to be a passing situation. Though individual enterprise has erected toll bridges since Colonial times and one such venture (displacing a ferry across the Susquehanna at Harrisburg) has been maintained continuously since 1817, private toll bridge construction in its modern phase may be considered a thing of the past ten years, like radio broadcasting or aerial surveying. With the opening of the Bear Mountain Bridge in 1923, built and operated by private capital under a State charter containing a recapture clause, the boom was on. Following it, private toll bridge construction rose until 1927 when 24 were built, but then came a decline and at present no new projects are under way.

Courtesy McClintic-Marshall Company

A STUDY IN SCALE — AND IN CURVES. BUILDING THE AMBASSADOR BRIDGE AT DETROIT

At first the privately financed ventures proved out because their entrepreneurs went slowly and investigated carefully, basing their estimates on traffic surveys of the early 1920's. In a way, these earlier bridges experienced the sort of phenomenal traffic growth which made the railroads so prosperous from 1900 to 1910.

Unfortunately, later bridge proposals were evolved with less care and, being without adequate legal guarantees against the competition of ferries, vehicular tunnels, and parallel free bridges, have often experienced difficulties in making ends meet. Then too, motorists kicked against paying tolls which they believed were purposely scaled high to yield a profit to private investors.

The unsatisfactory earning power of many privately operated toll bridges and the recognized wariness of capital when faced with the uncertainty of legislative franchises, have thus caused the publicly-owned type of toll bridges to become more common.

Hence the "revenue bond" method, hitherto often used for financing other public works, came to the front for the bridges. By this system toll revenues are pledged to pay interest and sinking fund on mortgage bonds which, because of their quasi-municipal character, benefit from a low interest rate. At this writing it seems to be the ultimate solution for most super highway bridge construction and it drives the private-financing method farther into the discard. Under its provisions the bonds are income-tax free in most instances and also are not subject to local taxation. Besides, the bridge itself is tax free, it is operated without profit, and the public constantly can measure definite progress toward the time when the mortgage indebtedness will be entirely redeemed and the bridge made free of toll.

A Letter to Alumni of the M. I. T.

AT THE Annual Dinner of the Alumni Association held on February 28 (see page 343) there was distributed a letter by Chairman Stratton and President Compton addressed to Alumni of the Institute and written to acquaint them with the work that the Institute is doing and the achievements toward which it aspires. The material in this letter deserves the widest possible circulation and we present herewith important excerpts.

The major needs of the Institute as listed in the letter include the following:

1. *Distinguished Professorships*

In order to secure outstanding men of the country and to stimulate younger men to work toward a distinguished career in the Institute, it is desirable to establish a small number of "distinguished professorships," open only to men of world-wide distinction and carrying salaries at least equal to those of the best professorships existing elsewhere.

2. *Endowment of Fundamental Sciences*

In order to strengthen the work of the Institute at its core, and to maintain its prestige as the leading center of applied science, it is essential that additional funds be secured to support research work in the fundamental sciences. Deserving of particular mention are physics, chemistry, geology (particularly geophysics), biology (particularly biophysics, biochemistry, bacteriology).

3. *Walker Memorial Extension*

Extension of Walker Memorial is extremely desirable to make more adequate provision for student and faculty activities and social life.

4. *Faculty Club*

A Faculty Club would do wonders for the *esprit de corps* of the staff, and experience with such clubs elsewhere shows that it would add to the effectiveness of their work.

5. *Building for Industrial Research*

A suitable building devoted to the activities of the Division of Industrial Coöperation and Research and operated somewhat along the lines of the Mellon Institute of Pittsburgh would be of great benefit to New England industries, would provide an additional training ground for our graduates, and would be nearly and perhaps more than self-supporting. It should, however, be conducted to supplement rather than to compete with such private organizations as exist to do similar work.

6. *Fellowships*

A certain number of good fellowships in the Graduate School, with stipends of $1,000 to $1,500, would go far to provide at the Institute a nucleus of the best graduate student talent of the country. Experience in other institutions has shown that this is a most successful way of building up a good graduate school and of promoting the advancement of knowledge.

7. *The Library*

This is the heart of any educational institution. The present library quarters are inadequate, not having been designed for the purpose and being overcrowded. The best solution of this problem would be a library building. The next best solution would be more adequate funds for operating the present library in the most effective way. A subsidiary need is a series of funds for support of relatively small departmental working libraries.

8. *Museum and Society of Arts Lectures*

The Society of Arts lectures, given primarily for young people of high school age in greater Boston, have been a tremendous success and even their repetition two or three times often falls far short of meeting the demand for seats. This shows that an extremely valuable contribution of the Institute to scientific education could be made by the establishment of a museum of science and industry, as was contemplated in the original charter of the Institute and planned for in the present quarters of the library. Such museums are meeting with great success in other large centers, such as New York, Chicago, Philadelphia, Detroit.

9. *Field House*

The present field house under the bleachers in the athletic field is inadequate. A better structure is urgently needed.

A fine athletic house and field house could be located on the vacant property of the Institute west of Massachusetts Avenue, at relatively small expense.

10. *High-Pressure Laboratory*

Important research work at high pressures is being done by the Department of Chemical Engineering in a small wooden shed to the rear of the main buildings. In conformity with the plan for the development of the Institute a high-pressure laboratory should be erected adjacent to the cryogenic laboratory.

11. *Endowment and Unrestricted Funds*

Except in so far as donors like to make their contributions for specific objectives in which they are personally interested, it is recognized that contributions in the form of unrestricted funds constitute the most desirable form of gift, since such a gift is always available for use in the direction of greatest need.

IN SPEAKING of the immediate future, Drs. Stratton and Compton discussed the cost of instruction and the proper remuneration of members of the Institute's staff. "Since the time of the Civil War," they wrote, "the

Corporation Nominees

NINE men each year are chosen by the Nominating Committee and presented to the constituency of the Alumni Association for it in turn to select three from the nine as candidates for Term Membership on the Corporation, legal governing body of the Institute. This year, because of the death of William E. Nickerson, '76, it is necessary to select an additional alumnus to fill Mr. Nickerson's unexpired term. The Nominating Committee, therefore, presents twelve names instead of the customary nine, and from these twelve selections of the Nominating Committee, the Alumni Association is to select four.

This group of twelve from which the four Corporation Nominees who will take office for five years, beginning July 1, will be chosen is composed of the following:

Left, from top to bottom

WILLIAM S. FORBES, '93
President and Treasurer, The Forbes Lithograph Mfg. Company
Boston

HENRY E. WORCESTER, '97
Vice-President, United Fruit Company
Boston

CYRUS Y. FERRIS, '04
Vice-President and Director, Stone and Webster and Blodget, Inc.
Boston

OSCAR G. THURLOW, '04
Vice-President of Allied Engineers, Inc.
Birmingham, Alabama

FRANCIS J. CHESTERMAN, '05
Vice-President and General Manager, The Bell Telephone Company of Pennsylvania
Pittsburgh, Pa.

SIDNEY T. STRICKLAND, '05
Partner, Strickland, Blodget and Law, Architects
Boston

Right, from top to bottom

EDWARD L. MORELAND, '07
Partner, Jackson and Moreland
Boston

THOMAS C. DESMOND, '09
New York State Senator
Newburgh, N. Y.

EMMONS J. WHITCOMB, '11
Vice-President, Raymond and Whitcomb Company
Boston

ARTHUR C. DORRANCE, '14
President, Campbell Soup Company
Camden, N. J.

MARSHALL B. DALTON, '15
Vice-President, Liberty Mutual Insurance Company
Boston

FRANCIS V. DU PONT, '17
President Equitable Office Building
Wilmington, Del.

To select the alumnus to fill the vacancy occasioned by the death of Mr. Nickerson the following three names of the above group are presented separately in the ballot: William S. Forbes, '93; Oscar G. Thurlow, '04; Emmons J. Whitcomb, '11. Out of this group of three, one is selected; out of the remaining nine, three are selected.

Photographs of Messrs. du Pont, Moreland, Dalton, Ferris, Strickland, Forbes, Dorrance, Whitcomb, Chesterman, and Thurlow; by Bachrach, Blank and Stoller, Inc., Gare, Phillips Studio, Underwood and Underwood, Trinity Court Studio, and DeLuxe Studio, respectively.

tuition has been increased four times, and next fall will be the fifth increase, when the tuition is raised from $400 to $500 per year. At this figure the tuition will take care of approximately half of the total cost of instruction. Another way of stating it is that it will take care of approximately the salaries of the instructing staff. It is reasonable that in a professional school the tuition should more nearly pay for the cost of instruction than in a school of the liberal arts type, and yet the present tuition is considerably less than that which is in operation in a number of the leading liberal arts colleges. Consequently there can be little criticism of the increase which is to go into effect next year, particularly since the liberal plan of scholarships and especially the great new loan fund provide that no worthy and promising young man needs forego the advantages of a scientific or technical education at this Institute because of lack of financial resources.

"The cost of instruction has various interesting aspects. Of course no one could defend extravagance in the running of an educational institution. On the other hand, no true believer in the Institute would wish its instruction to be of the type called 'cheap instruction.'

"In this connection consider the following comparison: the average salary of a full professor at the Institute was last year $5,080. At three sister institutions the salaries of full professors ranged respectively from $8,000 to $12,000, from $7,500 to $12,000 and from $8,000 to $14,000. Our associate professors last year received an average salary of $4,040, whereas in three sister institutions the salaries for this grade are minimum $6,000, maximum $7,000; minimum $5,000, maximum $6,000; minimum $5,500, maximum $6,000. Our assistant professors receive on the average a salary of $3,130, whereas in three sister institutions the corresponding salary ranges are minimum $4,000, maximum $5,500; minimum $3,600, maximum $5,000; minimum $3,500, maximum $5,000. Our instructors' salaries do not differ markedly from those in sister institutions of the first grade.

"These comparisons point to a very serious situation. They show that, particularly in the higher grades, the members of our staff are receiving salaries very inferior to those in other first class institutions, and this in spite of the fact that the competition for the services of first class men is much keener in an engineering or other professional school than in a liberal arts college, because of the competition with industrial concerns. This situation has led to three types of results: first, the Institute has lost some of its most valuable men; second, other men have remained at the Institute at a great financial sacrifice because of loyalty to it; third, a large majority of the men on the staff have been forced to supplement their Institute salaries by income derived from services rendered to outside agencies.

"The latter situation has created what is probably the most serious internal problem in the Institute. On the one hand, consulting work and engineering practice of a high grade are certainly valuable and possibly essential to the successful work of a man engaged in this profession, and certainly such work must be continued. On the other hand, it has been a serious detriment to have a situation which has forced numerous men to engage in a type of outside consulting work which does not contribute to the advancement of the profession or to the development of the individual engaged in it, but is simply undertaken because it is the means in sight for enabling the man properly to support his family. Furthermore this practice has led to great inequality in total income to the men engaged in various types or work, very much to the detriment of those who have chosen lines of work which may be of the greatest importance to science and engineering but which do not happen to have a monetary reward at the present time.

"In order to alleviate this situation, the Executive Committee has taken advantage of the increased income which is expected from the new tuition next year, to institute a new plan of faculty appointments as follows:

"Promotions and new appointments for the coming year will be at a substantially larger salary than hitherto, but will be subject to the condition that the man who accepts such an appointment will agree promptly to pay over to the Bursar 50% of income received for services to parties outside the Institute. The funds thus paid in to the Bursar shall constitute what will be known as a 'professors' fund' which will again be distributed as salaries among those who have been appointed on this new plan. In order not to work an injustice among those members of the present staff who have taken their position with definite understanding of opportunities for supplementing their salaries by outside work, or who have done this by common practice, any member of the present staff who is recommended for an increase in salary, will have the option of refusing this increase but remaining on the old plan with its privileges.

"In its essential features this plan is not new. Obviously this same type of problem has been a serious one for many years in many institutions. This new plan is quite similar to that which has been adopted in some foreign universities, for example, the University of Glasgow, and which is also in force in several institutions in this country. One institution in America, namely Chicago, has gone much farther than this in its professional schools of law and medicine in that appointees are required to turn back all fees received for outside services.

"The fundamental issue involved is really the definition of what is implied in the term of appointment to a full-time position on the staff of the Institute. There have been those who interpreted the terms of appointment as meaning merely the attendance to the scheduled class appointments, leaving the balance of time free for any outside activity, professional or otherwise. Against this it is maintained that the standard professor's schedule in vogue in all first class educational institutions is made as small as it is in hours per week with the expectation that the man shall devote the balance of his time to scholarly or professional pursuits for his own development and to the advantage of the institution. Consequently it is maintained that a full-time position at the Institute implies actually that the full-time professional services of the appointee are for the service of the Institute in any or all of its various activities, such as teaching, research, administration, or coöporation with business and with industry.

"The new plan is expected to result in greater freedom on the part of the professor in choosing his line of productive activity, and also a more equitable distribution

among the staff of the financial return from their services to the Institute. Since no plan can probably be devised which will be satisfactory for all cases, it is possible that some special appointments, as special lecturers or otherwise, may have to be made to supplement the ordinary type of new appointment."

OTHER interesting items in the letter included the statement that a simplification of schedule is being worked out by the Faculty whereby numerous courses which differ from each other in very minor particulars are grouped into one common course leading thus to less confusion in the schedule and in the long run to greater economy and effectiveness in conducting the work.

Limitation of enrollment, states the letter, seems to be a necessity since the educational plant is now being used almost to capacity and further increase in applications for admission will make it necessary for us to exercise some sort of selection in addition to the ordinary requirements for admission.

The letter also included a list of gifts and legacies received during the past year. Exclusive of the Loan Fund they total $703,199.96. The Loan Fund to which 18 men contributed will amount to $4,210,000 at the end of ten years.

Annual Alumni Dinner

ON FEBRUARY 28, at the Hotel Statler, the Association held its Annual Dinner. The occasion was marked this year by the presence of lady guests, and by the showing of an exhibit prepared by the Institute and graphically revealing many phases of Institute life.

Thomas C. Desmond, '09, President of the Association, presided at the dinner which was preceded by a reception held by Dr. and Mrs. Compton and Dr. Stratton. For 45 minutes before the dinner the guests had an opportunity to meet the Institute's Chairman and President as well as officials of the Alumni Association and the speakers of the evening. The dinner began at seven o'clock and was interspersed with dances between courses, a space having been provided for dancing in the center of the ballroom.

Professor Emeritus Robert H. Richards, '68, oldest living graduate of Technology, recounted to the guests some of his experiences in the early days of the Institute. He was followed by Professor Dugald C. Jackson, Head of the Department of Electrical Engineering, who spoke on engineering education. Professor Edward F. Miller, '86, Head of the Department of Mechanical Engineering, related a number of amusing episodes of student pranks in the old days.

A series of colorful and significant scientific experiments were conducted during the dinner by Dr. Thomas J. Killian, '25, of the Department of Physics, assisted by Mr. Shinji Togo of Tokyo, Japan, a graduate student in Electrical Engineering, and Mr. Harold Edgerton of the Department of Electrical Engineering. An artificial aurora borealis was produced in miniature by electrical discharges in rare gases. In a long glass tube devoid of air, electrical discharges through varying quantities of nitrogen, neon, helium, carbon dioxide, and argon gas produced flashes of red, blue, yellow, orange, green, and amber light. The blending and movement of the colors in the tube simulated the natural spectacular phenomenon of the aurora borealis.

This demonstration, the result of many years of study in electric discharges in various gases, provides a means for studying the constitution of gases, and the structure of the atoms and molecules in the gas. Cold light was produced in another experiment when Dr. Killian held a bulb containing argon and another containing iodine in a high frequency electrical field. In the first instance a brilliant white light occurred, and in the second, a vivid purple. A "snake dance" of color lighted up the entire ballroom in the final experiment of the evening, when a large current in a long tube illuminated the gases it contained.

Chairman Stratton spoke briefly of Institute affairs and of the advantages of the new administrative organization. President Compton closed the dinner formalities with a brief summary of Institute activities and problems. He stated that the greatest possible amount of revenue accruing from next year's raise in tuition from $400 to $500 will go toward raising faculty salaries to a figure more nearly approximating those offered by similar institutions. He also spoke of a number of important investigations and experimental researches now being carried on in the Institute in the interests of general engineering practice.

The program which was completed shortly after ten o'clock was followed by dancing and most of the 500 Alumni and guests attending the dinner remained either to dance or to talk. In many respects the evening constituted one of the most successful events that the Association has ever sponsored. Great credit redounds not only to the Committee on Assemblies, but to Mr. Desmond and his assisting officials of the Alumni Association and to the official Institute which contributed so freely and heartily toward making the dinner a success. Bursar Horace S. Ford who supervised the Institute exhibit did an admirable job. The decorative screens were executed by the Department of Architecture under the direction of Professor Harry W. Gardner, '94.

Alumni Council — Dormitory Dinner

IT IS indeed a season of mixed parties, as Mr. Desmond has so frequently pointed out. On February 13 members of the Alumni Council accompanied by lady guests met with students resident in Technology dormitories and their lady guests to celebrate the renaming of the dormitories. The dormitories in the new quadrangle behind Walker Memorial had for some time been laboring under the uninspiring designation of letters and numerals.

This combined meeting of Alumni and students was presided over by Harold P. Champlain, President of the Class of 1931 and Chairman of the Institute Committee. Mr. Champlain, as spokesman for the undergraduates, expressed the appreciation of the student body for the excellent dormitories made possible through Alumni aid.

President Karl T. Compton and Dr. Samuel C. Prescott, '94, Head of the Department of Biology and Public Health, were the principal speakers of the evening. Dr. Compton recalled his experiences as an (*Concluded on page 358*)

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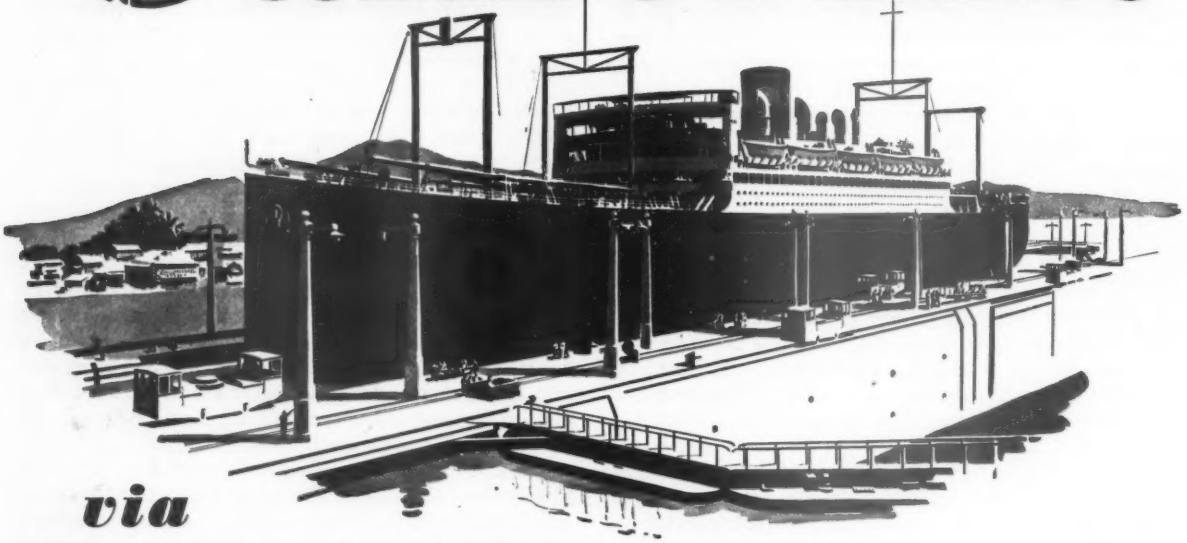

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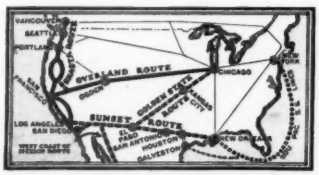

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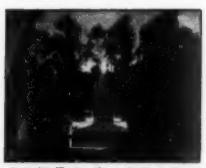

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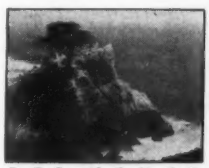

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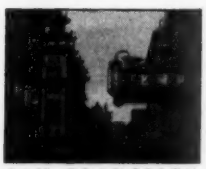

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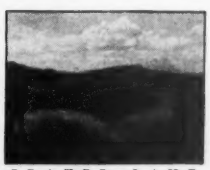

CRATER LAKE

PORTLAN

NIAGARA'S WAYWARD YOUTH

(*Continued from page 326*)

We know that business and æsthetic forces have been contending since water power development began; the first group for utilization of more of the water, and the second for the complete preservation of the scenic values. Failing to secure rights to a greater flow for power uses by direct appropriation, there has been suggested by the business group a compromise plan that would redistribute the water in the river above the Falls so that an ample supply for maintenance of the cataract spectacle would be assured and the surplus, not really needed for scenic purposes, might be taken out for use on the turbines.

As I write here in Washington, the news comes down from Capitol Hill that the Foreign Relations Committee of the Senate has, after two years of consideration, rejected the proposed treaty with Canada that contained some such plan as part of its text. It is the opinion of the Senators that the power interests would profit too much from the additional flow thus obtained and that the United States should do its own engineering in protecting the Falls, while the proposed treaty provided that the work should be done by the power companies who would divide the saved water between them.

So the play goes on. As Professor Shaler has said, the water that goes through the turbines will not cut back the Falls. It may be assumed that more and more water will be used for generating electric energy if it can be diverted and yet maintain the great spectacle in all its magnificence. And, finally, "if it seems worth while," the Niagara limestone may be supported by an underpinning of masonry and the Falls "nailed down" just where they are wanted.

A CITY OF TOMORROW

(*Continued from page 331*)

side issues of the New York developments, and no deep-water channels or docks are provided, it will involve the extension of the much-discussed lighterage system, already a bone of contention which has held back the development of New York for years. Certainly, if ocean-borne raw materials are to be lightered to reach the proposed industrial center in the meadows, there can never be a metropolis of any size. One has only to look up the tonnage of Port Newark or Elizabeth to realize that.

It is certain that the United States Government will undertake the necessary dredging eventually to bring into this meadow region vessels of deep draught, but no dredging will be executed if it is not needed. The deep-water port is the essential feature of the whole scheme. Congress has just appropriated a substantial sum to continue the work in Newark Bay, but probably will not continue to do so if this deep-water port is dropped from the plan.

The New Jersey Meadows Reclamation plan, therefore, begins with Newark Bay. The late General Jadwin, who was the chief consultant of the (*Continued on page 350*)

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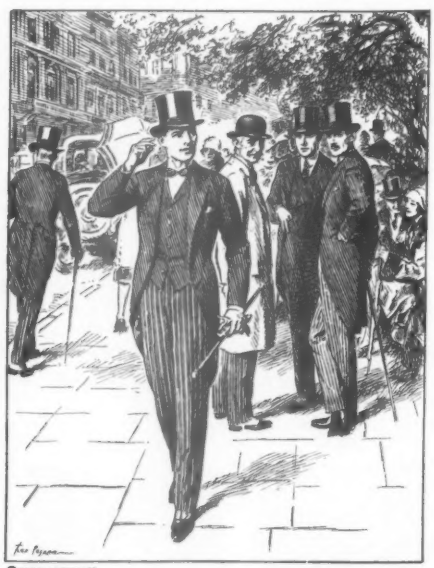

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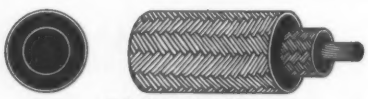

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A CITY OF TOMORROW

(*Continued from page 348*)

Commission, recommended 30 miles of deep-water berthing on the bay, ample for 300 ships of 500 feet in length. The passenger quay he would place at the conjunction of the Passaic and Hackensack rivers, known as Kearny Point. Port facilities in Newark Bay, he pointed out, would allow of direct transfer of freight from rail to vessel, and from vessel to rail, serving ten trunk-line railroads and he recommends the canal through the Bayonne peninsula already mentioned.

The housing plans of the Board were accepted by General Jadwin and his associate consulting engineers, but they do not look forward to housing all the workers in the meadows as many communities are already developed in reach of the proposed industrial section where there is land for sale and houses available. Then, too, there may be many workers who would prefer to live elsewhere, especially if the cost is less, and there are some people who prefer not to live under the most modern conditions.

To reclaim the meadows, build docks, fit up parks, relocate railroads and build roads and bridges, will cost a great deal of money. The dredging and filling alone for the Hackensack region is estimated to cost $120,000,000. As we shall presently see, there is even a greater sum required for a satisfactory water supply and sewerage system; as a matter of economy, the water mains and sewers should be built before the land is filled in. It is probable that that portion of the work which must of necessity be done by public agency may cost half a billion dollars. This means that the cost would be roughly $20,000 per acre, or somewhere near 50 cents a square foot, rather a large sum for vacant made land.

THERE are two other phases of the whole plan of reclamation which do not seem to have had adequate consideration. This region is not any too well supplied with water; the courts have had many cases involving local controversies over water supply. It is true that there is one project which may be developed, which would cover requirements for perhaps 50 years. This project, known as the Chimney Rock, utilizes the water from five New Jersey tributaries of the Delaware River, as well as a direct intake from that river; and from five tributaries of the Raritan River. The system would yield 750,000,000 gallons daily, and the cost is estimated at $184,000,000. The supply from the Delaware is, however, subject to the consent of the State of Pennsylvania, the State of New York already having consented to New Jersey's allotment. The New Jersey District Water Supply Commission said in 1925 that the six counties covered by this system would need an additional 100,000,000 gallons per day every eight years, and this does not take into consideration the meadows reclamation.

Again, such a city would require an enormous expenditure for an adequate sewerage system as no general sewerage system exists, although the meadows are surrounded by small municipal systems. The lower Hackensack River has been condemned by health authorities as polluted. The Passaic Valley has a general system west of the Passaic River, with an outlet (*Continued on page 352*)

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A CITY OF TOMORROW

(Continued from page 350)

at Robbins Reef. Sketches have been made for a general sewerage system for the upper part of the region, to cost some $180,000,000.

There seems to be no doubt that if any general scheme for the reclamation of the meadows is to be carried out at all, it must be by the State itself, either through its existing officials, or by some commission appointed for this special purpose. The legal power is vested in the State to do such work when it is an enterprise in which the public has an interest, and the State alone can exercise the right of eminent domain, and the powers of taxation. Those who are interested in this phase of the subject may well examine the report on the legal side of the question, in *Appendix C* of the fourth volume of the Regional Survey. That the control must be unified, and vested in some such commission, seems self-evident.

Bills have been introduced into the New Jersey Legislature to constitute such a commission, one of four regional commissions for the State. These would not be established until the bills pass the Legislature and are approved by the voters in the several districts at a referendum. There would be eight New Jersey counties in the North Jersey Regional Commission: Essex, Union, Passaic, Bergen, Hudson, Somerset, Morris and Middlesex. The commission, if constituted, would take over the work of the Meadows Reclamation Commission and the North Jersey Transit Commission, which have completed their survey and planning work. Whether the Legislature at the present session will pass this bill or a similar measure, or authorize any action at all, is impossible to predict at this time.

Whether any immediate action is to be taken, or the whole matter is allowed to remain in *status quo* for the present, the whole idea of reclamation as applied to this marsh embodies a program of municipality construction which is unique in its conception, and of gigantic magnitude.

Although quite separate from the plans for reclamation, a movement which is on foot to consolidate many of the municipalities in this region into one large city may have its effect on reclamation. Such consolidations are becoming quite common in the United States, the largest being that when New York City was formed from the various boroughs. A very recent publication by the

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National Municipal League, based on research financed also by the Russell Sage Foundation, gives a very full treatment of the organization and government of such consolidations, under the title, "The Government of Municipal Areas."

CAUSES OF MISBEHAVIOR

(*Continued from page 328*)

sixteen, the sex division showing an approximate parity. Careful survey of the medical and social histories of these children demonstrated that 104, or approximately one-sixth of the group, could warrantably be regarded as presenting behavior problems. In some instances, rather less than half, this was the major feature of the so-called chief complaint; in the remainder it was one fact in the history presented with varying degrees of emphasis.

The scatter of the behavior problems was a wide one. In the group were collected a homicide, a number of thieves, vagrants and incendiaries. Sex delinquency played but a very small part in the entire group, only four of the children warranting such a designation from the standpoint of a reasonable standard of conduct. A few children were pathological liars, a much larger number bullies, while egocentricity, viciousness, disobedience, and asocial and anti-social conduct were represented in significant proportion. From the writer's own contact with the children he would feel that the report of egocentricity fell far short of its actual presence. In many instances, however, intense selfishness on the part of the child was no more than an inevitable outcome of an uncritical and highly injudicious parental over-solicitude. Equally, many of the so-called morose children presented no more than a different personal reaction to this same exciting cause. In addition to the actual behavior problems as such, certain mental traits were reported in many of the cases which must be regarded as definitely causative or contributory to the major condition. Mental retardation, the existence of various phobias, and numerically most important, the presence of grave emotional instability are to be listed. Fully two-fifths of the entire group were reported in this last class, and a more critical analysis of the remainder would have led to the inclusion of many of them.

It will be remembered that these children had all received a very careful and complete diagnostic study, the end result of which had been the establishment of the existence of various disease conditions and functional derangements determining the purely medical aspects of the case. On the basis of these studies it is possible to group the children in accordance with the etiology disclosed by the diagnostic study. In round numbers two-thirds of the children presented as the major condition a functional derangement of one of the endocrine glands. The great majority of these children were pituitary cases; a much smaller but still significant fraction exhibited disturbed thyroid function. Only two of the entire group showed a condition associated with the primary organs of sex, a fact the implications of which need not be discussed in this presentation.

The remaining third of the behavior group gave no evidence of any involvement of any of the ductless glands but could, on the other hand, (*Continued on page* 354)

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CAUSES OF MISBEHAVIOR

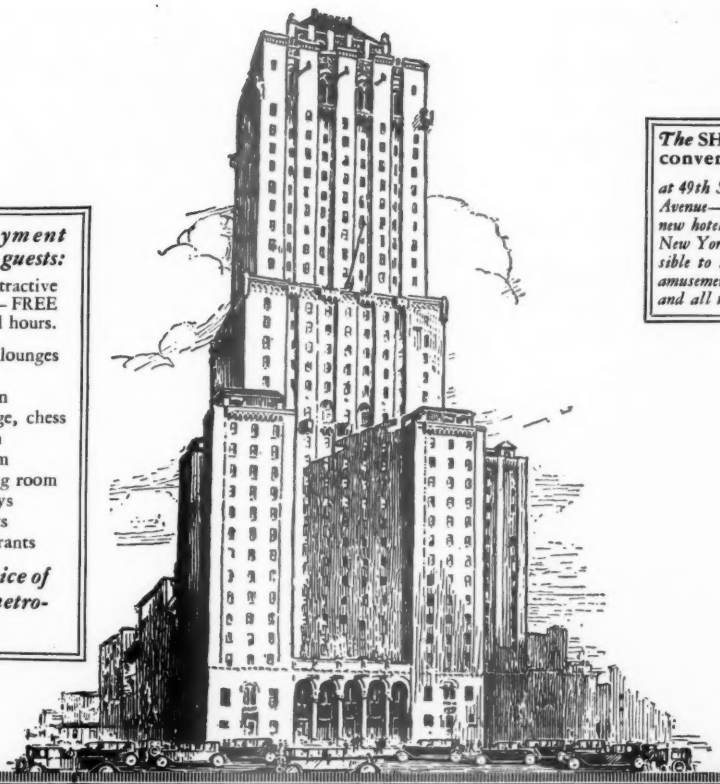
(*Continued from page 353*)

be placed specifically into two somewhat elastic categories. The dominant fraction (28) were classified as neurological cases, with those demonstrating lesions of the central nervous system constituting two-thirds of the group. The second and smaller fraction of the non-endocrine cases (8) all gave evidence of toxic states associated with severe infective processes. Of the much larger group of children in the original selection in whom no behavior problem was reported, there existed a very wide scatter of other disease conditions. None of these, however, contributed to the behavior group, there being seemingly in them no association between a social and a medical problem.

In any individual the existence of a primary disease condition or functional derangement does not eliminate the coëxistence of other similar departures from the normal which are secondary in import to the first and may or may not be associated with it. Recognizing this fact, it seemed to be significant to analyze the entire series of little patients from the standpoint of the incidence of head injury which could produce damage to the central nervous system. The predominance of this single factor in the non-endocrine group pointed directly to the utility of such analysis. The principal indices were the records of trauma either at birth or during the later years, a past history of known disease such as encephalitis or meningitis, and the existence of physical stigmata which could derive only from brain injury. Over half of the endocrine and two-thirds of the non-endocrine groups, together a total of 61% of the series, gave evidence of some type of head injury. If to these, for anatomical reasons, be added the remainder of the pituitary cases, the number of children with existent or implied head pathology assumes a dominant proportion in the group. It does not, however, comprehend them all and this fact must be borne rigorously in mind in any final interpretation.

A SURVEY of the large amount of material drawn from the clinical and laboratory studies of these little patients can find no place in the presentation of this material. It may be said, however, in summary that throughout the entire group there existed unmistakable evidences of profound metabolic disturbance. While these evidences varied in degree and in kind from case to case, not one of the children in the group failed to exhibit a series of purely objective indications of significant physical disorder.

That such a condition should exist in the endocrine group, is no more than would be anticipated as the glands of internal secretion are among the potent regulators of metabolism and of bodily function. The evidences in the non-endocrine group, however, were equally clear cut. Metabolic disturbance constitutes one positive, demonstrable feature common to every member without exception of the entire group. Metabolic disturbance, further, is estimated and measured in purely objective terms, leaving no room for the variations of opinion which might be found in more subjective types of evidence. The behavior problem is a second (*Concluded on page 356*)



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CAUSES OF MISBEHAVIOR

(Concluded from page 354)

putative common finding, but as was discussed in the body of the text, its definition lacks the clear-cut objectivity of the preceding factor. There is, then, in this group an association — for it is no more than that — between a group of constitutional factors and a variety of behavior problems. It must not be forgotten, however, that this group of children presenting behavior problems was drawn from a much larger consecutive series in which the individual case presented the same or similar etiological background without, however, conforming to the present criterion of selection. The only warrantable interpretation from this evidence would seem to be that there is a third factor not touched upon in the preceding discussion. For want of a better term this could be designated as the "constitutional tendency," a state implying an integration of known and unknown hereditary and environmental factors, and the whole producing an habitus peculiarly susceptible to certain outside agencies. In the present group the common factor which has been objectively demonstrated is that of a disturbed metabolism, the latter arising through a variety of agencies and acting, directly or indirectly, through the hormone control of the endocrine glands or through the manifold intrinsic functions of the nervous system, or through one or both, working independently or together. In the present group the union of these two major agents would seem to be associated with the existence of a mental status engendering a behavior problem. The word "associate" is used advisedly, as an attempt to establish a definite causal relationship in the light of our present knowledge would involve a series of assumptions for which no established warrant exists.

ONE more consideration may be touched upon briefly. The metabolic factor may derive from organic change as in those cases presenting lesions of the central nervous system, or from functional derangements as primarily shown in the individuals presenting an endocrinopathy. While the first group must be regarded as demonstrating a condition insusceptible of correction, experience has shown that in many instances, at least, lowered functional levels of the individual glands may be restored to the normal by the therapeutic use of active principles derived from the same glandular structures of other animals. The whole field of endocrine therapy is steadily progressing, in largest measure as the result of the brilliant work done by the biochemists and physiologists. These scientists are gradually solving the problems of the production from the various animal sources of biologically active material. In the child demonstrating a glandular failure the use of such therapy is clearly indicated for the purpose of normalizing the levels of physical function, deranged through the aberration of the endocrine gland at fault; in such normalization experience has already demonstrated that associated individual problems of behavior have been simultaneously resolved. Even this does not establish a causal-resultant relationship but it does give warrant for the hope that in the physical normalization of the endocrine child with a behavior problem a correction of the latter difficulty may be a by-product. For the present one is not permitted to generalize further. When reported cases number thousands instead of hundreds the physical elements may assume sharper outlines of definition. When we are able to reduce the delineation of the behavior problem to a more objective basis, when we are able to make due allowance in our estimate for factors which today may only be designated as extraneous, when, in short, we can define aberrant behavior in terms of common acceptation and agreement and with due allowance for the mutability of the dominant social factor, then it may be possible to demonstrate a closer interrelationship and thus indicate more sharply the lines of curative or of palliative approach.

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THE INSTITUTE GAZETTE

(Concluded from page 343)

undergraduate at Wooster College and later at Princeton University. He recounted several unfortunate experiences of faulty supervision of dormitories which could never occur at Technology due to the efficiency of the Dormitory Committee and the strength of the undergraduate student government.

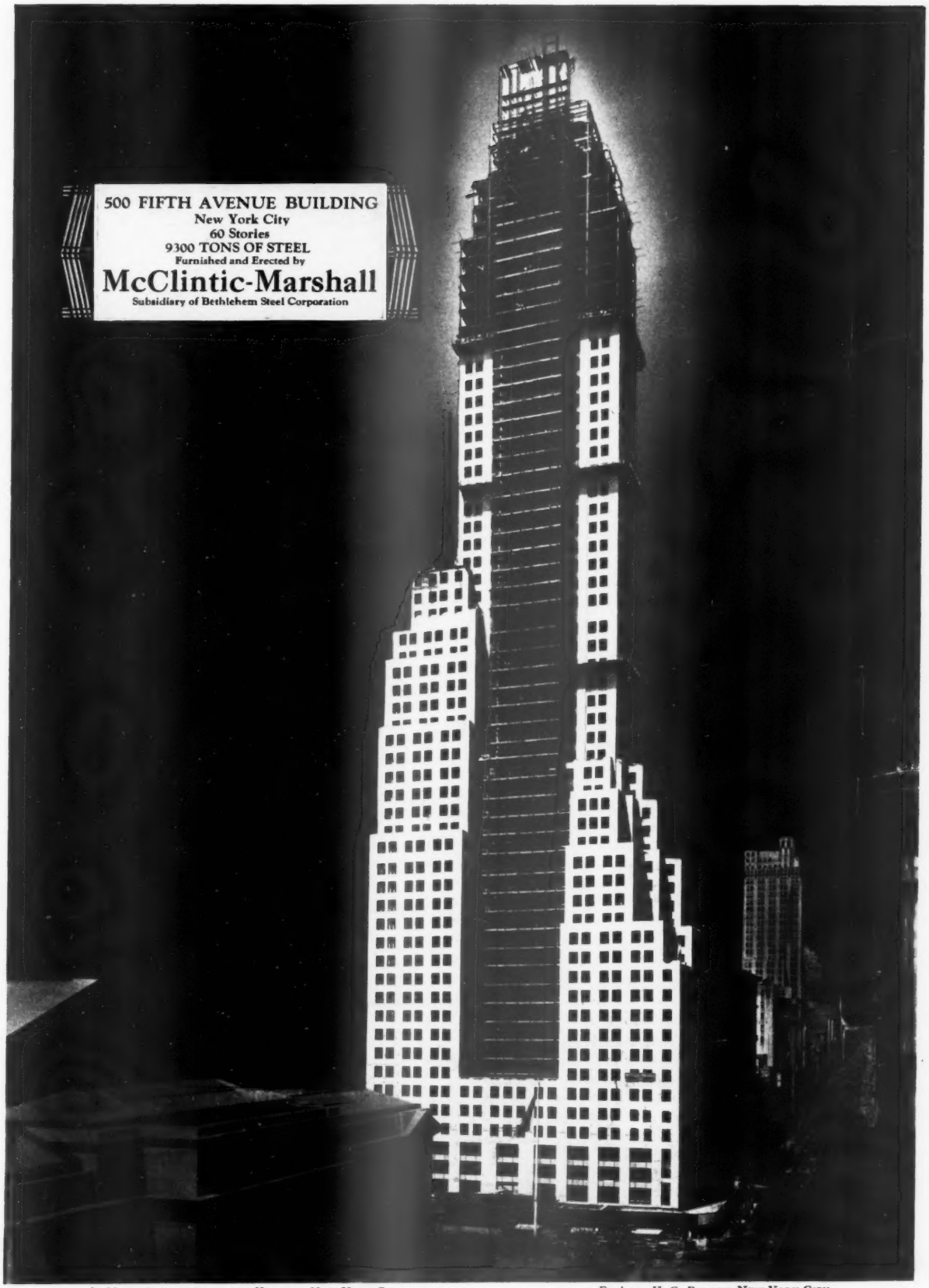
To Dr. Prescott, as Chairman of a special committee of the Alumni Council to name dormitories, consisting of Thomas B. Booth, '95, and Gorton James, '10, was accorded the honor of informing the dormitory men of the names of the new units. "It is my privilege," said he, "to say a few words regarding the buildings, but I shall try to make my remarks brief. You are undoubtedly, in part, familiar with the history of these buildings, the work for which was begun five years ago by the Alumni Association under the presidency of Mr. Charles Hayden, '90. . . .

"Nearly 1,400 Alumni, impressed with the desirability for more dormitories, responded to the idea and their contributions augmented by the generous action of the Corporation has made possible the construction of these new buildings. With their completion, the Alumni Council appointed a committee to suggest inscriptions which might suitably commemorate the action of the Alumni, and this committee assumed that a part of its duties might properly be to recommend names for the structural units or houses which compose this group. . . .

"As the older group of dormitories, in which the units are named for early professors of distinction may be regarded as the Faculty Group, the newer group, with such connecting buildings as may later be added to complete the quadrangle, is to be known as the Alumni Group. The men whose names I shall read to you have not been selected for this distinction simply because of their generous gifts of money for the construction of these dormitories; nor have they been chosen solely because of their interest in the welfare of the student body — great and important as this is. They have been chosen and will stand before you and your successors because they represent the types of citizenship and professional service of integrity, high character, and manhood which we would like to have held perpetually before every student."

The first unit in the group in which is located the common lounge and social room is named Munroe in honor of the late James P. Munroe, '82. The other Alumni honored with dormitories bearing their names are: Charles Hayden, '90; A. Farwell Bemis, '93; the late Charles W. Goodale, '75; the late Kenneth F. Wood, '94; and the late William W. Walcott, '01. The units previously named "1893" and "1901" are known as "Bemis" and "Walcott" respectively. The social room in Munroe is named "Burton" in honor of Alfred E. Burton, Technology's first Dean of Students.

Preceding the combined dinner and dance with the dormitory men, the 150th Meeting of the Alumni Council was held, presided over by Donald G. Robbins, '07, Vice-President of the Alumni Association. At this meeting, the Committee to Determine Official M. I. T. Colors was commended and discharged.



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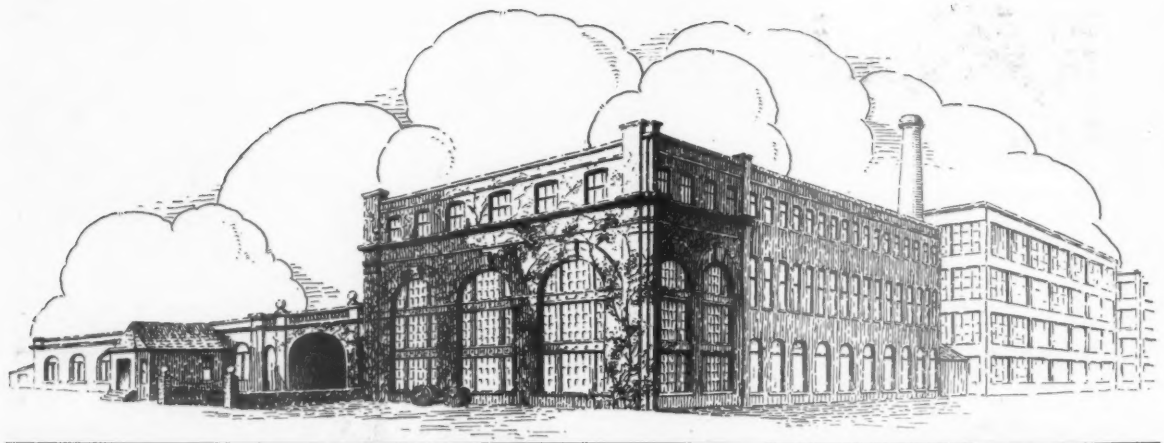

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is the Edison dictating machine for business correspondence which makes unnnecessary the writing of letters twice—once in shorthand and once on the typewriter. The average dictator gains an hour a day—a month a year—with Ediphone facility; the stenographer gains 50 % in time useful for other work and letters cost about half as much. Edison Service is world wide.

EDISON WOOD PRODUCTS AND SPECIAL MANUFACTURES

Juvenile furniture, cabinets for radios, banquet and bridge tables, chairs for home and industrial use are but a few of the products manufactured at the Edison plant in Wisconsin. Precision instruments, special electrical apparatus and a host of other special manufactures, both small and large, are produced for industry in the plants of Thomas A. Edison, Incorporated.

EDICRAFT PRODUCTS

This group of appliances includes the Edicraft Automatic Toaster, the Edicraft Coffee Siphonator, the Edicraft Sandwich Grill and the Edicraft Waffle Baker. With these appliances it is possible to cook complete menus right at the table with little preparation. The Edison Birka Heat Regulator which controls temperatures in these appliances makes this table cookery automatic.

THE EDISON PRIMARY BATTERY

Edison Primary Cells are used to fill what would be a serious gap in the general field of electric power generation. This gap occurs most frequently in the case of electric signal devices where the total amount of energy required is relatively small and where extreme reliability and freedom from attention are of paramount importance.

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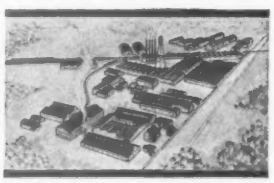

Charles Almy, Jr. '10
E. A. Bianchi '29
G. C. Canfield '25
H. B. Canfield '22
C. A. Carey '25
F. N. Cramton '26
Bradley Dewey '09
H. S. Ferguson '23
L. H. Goodhue, Jr. '30
Fisher Hills '29
L. W. Isom '30
R. W. Leach '22
J. A. Lunn '17
G. E. Mason '25
Maurice Mason '21
V. W. McDaniel '29
E. L. Mears '30
T. T. Miller '22
S. B. Neiley '22
J. J. O'Brien '29
H. C. Pearson '23
R. Piez '29
A. J. Puschin '28
Arnolf Rehbock '30
A. G. Richards '19
W. C. Ross '24
D. L. Shanklin '23
W. J. Slagle '29
W. L. Taggart, Jr. '27
Kenneth Tator '30
G. R. Tucker '25
F. E. Walsh '26
H. M. Weddle '29

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THE TABULAR VIEW

APPLIED geophysics — what is it? Few laymen are aware of the development and uses of this new applied science and of its importance in the world's economy. Prospecting is, of course, one of the chief functions of the mining and petroleum engineer. As the more apparent locations of oil and minerals in the earth's surface have already been found, it has been necessary for the mining engineer to refine his prospecting methods and to substitute for an age-old technique improved means of discovery. The traditional divining rod, satisfactory to the superstition and credulity of an earlier age, has been supplanted by the applications of instruments developed by science. "Magnetic needles, delicately adjusted, point to iron; the electric plummet discloses the presence of other metalliferous ores, and the seismograph and torsion balance become indispensable aids in revealing the location of new oil pools." Applied geophysics, then, may be defined as the application of physical science to the study of the earth's structure in a commercial way. ¶ Because applied geophysics, or physical prospecting, is to most people merely a phrase and nothing more, The Review is happy that it can present such a lucid exposition of its methods and procedures as that prepared by Mr. ROLAND F. BEERS and presented on page 375. Mr. Beers has had a great variety of experience in making geophysical surveys for oil companies in Texas and Oklahoma. After receiving a degree in Electrical Engineering from Rensselaer Polytechnic in 1921, and while employed in the Raytheon Laboratories in Cambridge, he took part-time courses at the Institute in Course VI-C, finally obtaining his master's degree in 1928. After leaving the Institute, he went to the Southwest as a Party Chief with the Geophysical Research Corporation.

MR. LOBDELL, publisher of The Review, it will be recalled, was the author of a comparative study of American and European train speeds published in the February Review. His article on locomotives in this issue is the first of a series of two.

THE history of chemistry has long been one of the chief interests of Professor TENNEY L. DAVIS, Contributing Editor to The Review. "The Pill of Immortality," which he contributed for this month, deals with the early history of alchemy and was written with LU-CHIANG WU. Mr. Wu, of the class of 1928, now doing graduate work at the Institute, translated the passages from one of the Taoist Classics purporting to be a commentary on the Book of Change. It is in reality, however, a treatise on the preparation of the pill of immortality. ¶ After his graduation from Technology in 1913, Professor Davis continued his studies at Harvard where he received his master's and doctor's degree. In 1919 he joined the Institute's Instructing Staff, and since 1926 he has been an Associate Professor of Organic Chemistry. His keen interest in the history of chemistry opened the way to his election as Secretary for the Division of the History of Chemistry of the American Chemical Society in 1927. He

(*Continued on page 368*)

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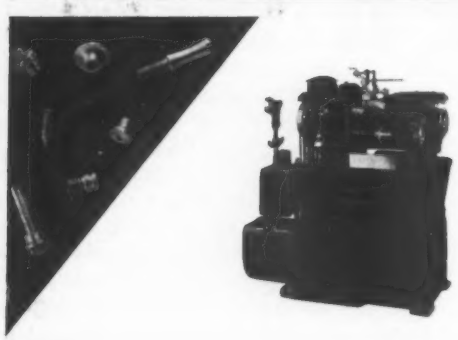

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THE TABULAR VIEW

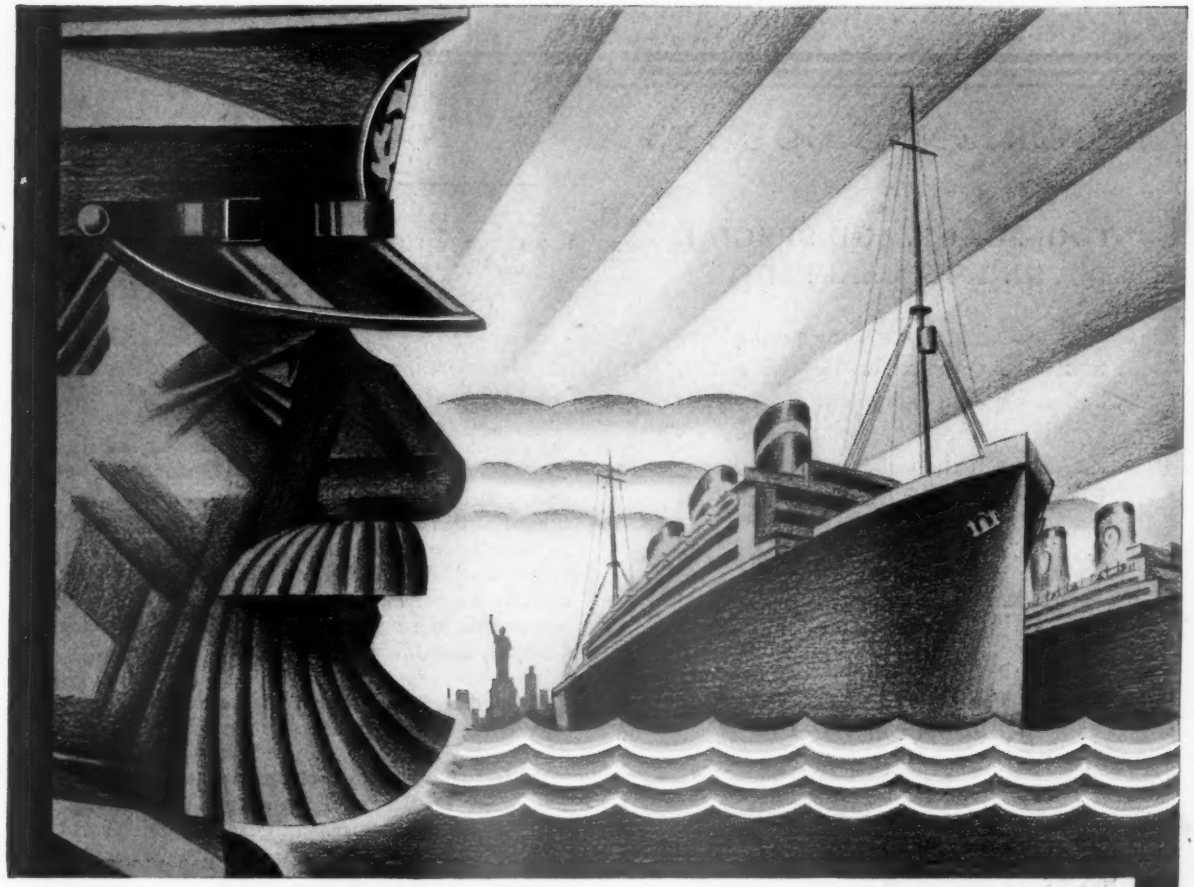
(Continued from page 364)

has collected an unusual library on this his favorite subject. In the July, 1929, Review Professor Davis contributed an article on the beginnings of authentic science.

Perhaps like every human woe
It springeth from the radio.

DELICATE geophysical instruments are not required to detect in the upper strata of the American people a growing displeasure with radio broadcasting in this country. The persistent, distasteful, indiscriminating, advertising jargon that fills such a large part of the programs is the chief source of discontent. Radio broadcasting, the child of big business, is also big business's ballyhoo artist. What can be done about it? Such an enormously valuable instrument of civilization should never be corrupted; it should not even be misused. Professor ROBERT E. ROGERS examines this problem in his article on page 386. He points to radio's tendency to usurp the function of the newspapers and to the failure of our scheme, supported by advertising, to give radio entertainment compatible with normal, human intelligence. After a particularly thorough pathological consideration of American radio he concludes with some suggestions for mitigating the present undesirable conditions. ¶ A correspondent of the New York *Times* in a letter to that newspaper last month made some suggestions that in many ways supplement Professor Rogers' remarks. His first suggestion for reform is the necessity for conducting broadcasting as a public service without any form of commercial motive. The second point concerns the central, unified control of radio service, free from the all-pervading spirit of competition. Third, the service should be established under the auspices of the State but not conducted by the State. Fourth, there should be adequate financing through a licensing system or in some way that does not put the public at the mercy of the advertisers. "The ether should not be put at the power of money." ¶ Several things become plain from the trend of these criticisms: that the public doesn't know its own mind; that it is susceptible to good influences as well as to the mediocre or unworthy; and that the solution of the middle-class taste problem does not necessarily mean a general lowering of standards to the "level of 13-year olds," but may lie in the furnishing of genuine entertainment, which after all has a fundamentally universal appeal when allied to art. ¶ Professor Rogers was graduated from Harvard in 1908 and received his master's degree in 1909. He has been a teacher in the English Department at the Institute since 1913, serving as Editor of The Review from 1917 to 1922, the only non-Technology man to hold that position. For a number of years he has been connected with the Massachusetts Division of University Extension and it was under their auspices that he broadcasted a course in American literature in 1924, one of the earliest experiments in education by radio.

(Continued on page 370)



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THE TABULAR VIEW

(Concluded from page 368)

This type of radio education was a unique experiment as it was the first time that listeners were given an opportunity to pay for their entertainment. His experiences in this field were described in an article by him entitled "Radio's Coming of Age" which appeared in the May, 1925, Technology Review.

WILLIAM H. MUESER, the author of the article entitled "11,000 Tons on Wheels," is a graduate of the Institute in the class of 1922. He later attended the Technische Hochschule Zu Berlin, Germany, for over a year, and in the fall of 1923 became associated with the firm of Moran and Proctor. This firm specializes entirely in foundation engineering and has to its credit and reputation the successful completion of many large and difficult foundation projects. Mr. Mueser was project manager in the moving of the Indiana Bell Telephone Company's building described in his article.

HAROLD B. WARREN is the artist whose water color of the Parthenon is reproduced on the cover of this issue. He also executed the water color of the cathedral at Chartres which appeared on the cover of the December, 1930, issue. Previous to his retirement, Mr. Warren was an instructor in Drawing and Water Color in the Schools of Architecture and Landscape Architecture at Harvard University.

IN THESE columns last month we quoted a delightful bit of verse about the adrenal glands and heroism. Since then another startling announcement has inspired the following piece by L. H. ROBBINS in the New York *Times:*

A MANGANESE LULLABY

Mother love, a Johns Hopkins scientist finds, is due to a trace of manganese in the mother's food, and may disappear when the element is eliminated from her diet.

Close your eyes, my baby,
  Sleep, my precious dear.
Mother's ways have, maybe,
  Seemed a bit austere,
But now, at last, she means to cease
  From knocking you about.
Mamma's taking manganese
  To bring her fondness out.

Is mother acting funny
  To cuddle you like this?
Never fear, my honey,
  Nothing is amiss.
Close your baby eyes in peace
  And smooth your infant brow.
Mammy's adding manganese
  To her diet now.

FOR those readers of The Review who are not familiar with its publication schedule, we call attention to the fact that no issue appears dated June. The next and last issue of this volume will be that dated July, which will be in the mails on June 27.